

Environmental Protection and the Right to Food

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U. S. President Calvin Coolidge is said to have explained once that the cause of unemployment is people out of work. Similarly, there is general agreement that the cause of hunger is people out of food.⁽¹⁾ Unfortunately, in most discussions of world hunger and the right to food, agreement ends at this point. The Coolidge formula obviously fails to address the issue of why people lack work or food. The answer sometimes given for sectors of unemployment - that there are those who choose not to work - is clearly inapplicable to food shortages; the malnourished and hungry do not volunteer for their condition. They are, instead, victims of multiple dislocations and conditions, mostly human caused, which deprive them of necessary sustenance. The Brandt Commission in 1980 stated that it saw "no more important task before the world community than the elimination of hunger and malnutrition in all countries" recognizing that "this is not a limited task - it involves nearly all aspects of the world economy and the development process, to create and distribute both the required food and the employment and incomes which will enable the food to be bought by those who need it".⁽²⁾

The following discussion looks at the problem of global hunger, then analyses the right to food as it is expressed in international human rights instruments. Finally, it addresses the inextricable link between environmental protection and implementation of the right to food.

(1) Among the literature discussing the right to food, see P. Alston, K. Tomasevski, eds. *The Right to Food* (1984); A. Eide, W. B. Eide et al, *Food as a Human Right* (1984); I. Brownlie, *The Human Right to Food* (Commonwealth Secretariat, Human Rights Unit Occasional Paper), 1987; United Nations, *Right to Adequate Food as a Human Right*, 1989;

(2) Brandt Commission, 1980, p.3.

1. The Scope of World Hunger

The number of hungry and malnourished people is not known, nor are there accurate statistics on how many die of starvation each year. Recently, based on UNICEF statistics, it was estimated that more than one billion persons are chronically hungry, with 13 to 18 million people dying each year as a result of hunger and starvation.⁽³⁾ This figure corresponds to 24 deaths every minute. Children are the most severely disadvantaged, with hunger causing perhaps 60 percent of all infant deaths⁽⁴⁾ and children under five years of age comprising more than three-fourths of all hunger-related deaths. Although other figures vary considerably due to definitional problems and statistical deficiencies, it seems safe to say that, globally, there are millions of deaths each year that can be attributed directly to lack of adequate food.

In addition to the numbers who die of starvation, millions more suffer from chronic malnutrition. In 1984, FAO estimated that 500 million persons were suffering from severe malnutrition.⁽⁵⁾ Nutritional deficiencies affect learning ability and capacity to work, as well as the behavior and well-being of large segments of the population.⁽⁶⁾ Thus, a whole range of problems are linked to the right to food, and violation of this right impacts upon other human rights, including the rights to life, to health, to education, and to work.

Although there are the many conflicts about the scope of the hunger problem and its causes, there are certain areas of agreement: one, that *for now* there is sufficient food being produced globally that if it were adequately distributed, there would be enough to satisfy the needs of the world.⁽⁷⁾ However, it is estimated that 50 percent more food will have to be grown by the end of this century to meet nutritional needs.⁽⁸⁾ At the same time, the rate of increase of food production is declining⁽⁹⁾ and each increase in production becomes more costly.⁽¹⁰⁾ Growing demand threatens to generate further crises. In ecological terms, it is clear that world popu-

(3) United Nations, *Right to Adequate Food as a Human Right*, *supra* n. 1 at 2.

(4) *Id.* p. 4.

(5) *Hunger Primer*, National Committee for World Food Day (Washington, D. C., 1984).

(6) Ber, *Malnourished People: A Policy View* (World Bank, 1981), p. 1.

(7) U. N., *Report of the Food and Agriculture Organization (FAO) to the Human Rights Commission*, E/CN.4/1986/38/Add.2, para. 8.

(8) Forward, World Soil Charter, 1982.

(9) It was expected that cereal production in 1991 would fall below consumption demands in 1991/1992. FAO, *The State of Food and Agriculture 1991*, C91/2, p. 2.

(10) In recent years, it has taken 50% more energy to produce 30% more food. R. Lal, D. J. Eckert, N. R. Fausey, and W. M. Edwards, "Conservation Tillage in Sustainable Agriculture", in C. Edwards, R. Lal, P. Madden, R. H. Miller and G. House, *Sustainable Agricultural Systems*, (Ankeny, Iowa, 1990) pp. 203-204.

lation levels are growing faster than the food supply and that there are limits to the ability of the environment to produce more food. In fact, as discussed below, many efforts to increase productivity are destructive of the environment and result in further reducing arable land available for food production.

The second point is that malnutrition is largely a reflection of poverty. In addition to problems of famine created by exceeding the carrying capacity of the environment, the increasing food demand escalates prices beyond the reach of the poor. According to the FAO, 55-60% of Africa's rural population lives in absolute poverty.⁽¹¹⁾ The gross disparities in income and wealth existing both between and within nations are basic to the world food problem. Thus, even higher food output and reduced population growth, necessary elements in any long-term program to eradicate hunger, do not guarantee elimination of the problem. More equitable distribution of wealth and income are equally necessary.⁽¹²⁾

The problems are complex and interdependent. In many countries, much of the most fertile soil has been given over to the production of cash crops for export with a resulting decrease in grain production. Crippled by enormous debts and debt-servicing, many countries rely on the agro-export sector to bring in foreign exchange earnings.

Apart from ecological conditions and the economic system, basic causes of hunger can be found in history (colonialism, slavery, wars, etc.), ideology and culture, and in the political and legal structure of various countries. With these multiple factors producing shortages, it appears that unless there are fundamental changes, the problem of hunger will only increase. Among the urgent changes required are measures necessary to protect the environment on which all food production is dependent. In this regard, it can be argued that the obligation to take action to protect the environment, at least as directly related to food production, is encompassed within state duties corresponding to the internationally recognized right to food. At very least, the right to food cannot be implemented without actions to protect the environment and without use of techniques first developed by environmental law.

II. The Right to Food in International Instruments

The right to food forms part of contemporary international law, being included in nearly all global human rights instruments and, on the regional level, in the ESC Protocol to the American Convention on Human Rights. However, the first elements of a right to food appeared in rules of humanitarian law.

(11) FAO, *The State of Food and Agriculture 1991*, *supra* n. 7, p.46.

(12) See Philip Alston, "International Law and the Human Right to Food", in *The Right to Food* (P. Alston, K. Tomasevski, eds.), 1984, pp. 10-11.

The Hague Regulations of 1907 concerning land warfare, in article 7, guaranteed provision of food to prisoners of war on the same basis as troops of the capturing force. This limited protection was extended in the Geneva Conventions of August 12, 1949 and the 1977 Protocols.⁽¹³⁾ Article 26 of Convention III (prisoners of war) provides that:

The basic daily food rations shall be sufficient in quantity, quality and variety to keep prisoners of war in good health and to prevent loss of weight or the development of nutritional deficiencies. Account shall also be taken of the habitual diet of the prisoners. The Detaining Power shall supply prisoners of war who work with such additional rations as are necessary for the labor on which they are employed. . . Collective disciplinary measures affecting food are prohibited.

Similarly, Convention IV relating to civilians requires that an occupying power, to the fullest extent of the means available to it, ensure the food and medical supplies of the population. This obligation includes bringing in necessary foodstuffs if the resources of the occupied territory are inadequate.

Article 14 of the Second Protocol is most explicit in prohibiting starvation of civilians as a method of combat. There can be no attack on foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works. On the other side, there is an obligation to permit relief measures where necessary to alleviate undue hardship.

More generally, human rights texts adopted since the Second World War have included the right to food among listed human rights. The Universal Declaration of Human Rights of December 10, 1948, provides in article 25, paragraph 1 that:

Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food. . .⁽¹⁴⁾

This formulation goes beyond freedom from hunger to an entitlement to the amount of food adequate for health and well-being.

The U.N. Covenant on Economic, Social and Cultural Rights⁽¹⁵⁾ is the most important international agreement containing a right to food, detailing the principle

(13) Protocols Additional to the Geneva Conventions of 12 August 1949 and Relating to the Protection of Victims of International Armed Conflicts, 1125 U.N.T.S. 3 (P.I); 1125 U.N.T.S. 609 (P.II); 16 I.L.M. 1391.

(14) G. A. Res. 217A (111), U.N. Doc A/810, December 10, 1948. During the drafting of the Universal Declaration, other more specific proposals were made concerning the right to food. One draft would have provided that "everyone without distinction as to economic and social conditions, has the right to the preservation of his health through the highest standard of food . . . which the resources of the State or community can provide". UN doc. E/600 (1947) Annex A, article 25.

(15) UN Covenant on Economic, Social and Cultural Rights, G.A. Res. 2200 (XXI)(Annex); 6 I.L.M. 360 (1967).

set forth in the Universal Declaration. The Convention has been ratified or acceded to by 104 states as of the beginning of 1992. Its article 11, inspired by the FAO⁽¹⁶⁾, provides:

1. The States Parties to the present Covenant recognize the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions. The States Parties will take appropriate steps to ensure the realization of this right, recognizing to this effect the essential importance of international cooperation based on free consent.

2. The States Parties to the present Covenant, recognizing the fundamental right of everyone to be free from hunger, shall take, individually and through international cooperation, the measures, including specific programs, which are needed:

(a) To improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources.

(b) Taking into account the problems of both food-importing and food-exporting countries, to ensure an equitable distribution of world food supplies in relation to need.

Article 11 encompasses two separate norms as part of the right to food. The first, in paragraph 1, provides that everyone is entitled to the right to food as part of the right to an adequate standard of living. The second paragraph establishes the right of everyone to be free from hunger. The first, broader standard implies that there should be enough food to permit an active, normal existence, not simply avoid death by starvation. Interestingly, the right to freedom from hunger is the only right in both human rights Covenants to be specifically designated as "fundamental".

To implement the right, each state is required, according to the terms of Covenant article 2, to take all appropriate steps, to the maximum of its available resources, to ensure progressive realization of the right of everyone, without discrimination, to adequate food. States parties to the Covenant also are required to take steps through international assistance and cooperation, especially economic and technical, to the maximum of their available resources to achieve realization of this right. In carrying out the duty of international cooperation set forth in article 11(1), certain steps are specified in article 11(2): improve methods of food production with a view to promoting realization of the right to food; improve methods of food conservation with a view to promoting realization of the right to food; and improve methods of food distribution with a view to promoting realization of the right to

(16) For the drafting history of article 11, see P. Alston, *supra* n. 1 at 30.

food. For each of these, the article provides that states should make full use of technical and scientific knowledge; disseminate knowledge of the principles of nutrition; and develop or reform their agrarian system. Environmental considerations are incorporated in the requirement that states parties take measures to achieve "the most efficient development and utilization of natural resources".

Implementation thus involves state obligations to respect, protect, and ensure fulfillment of the right to food. Respect and protection involve a duty of due care, while the duty to ensure requires more. Within the obligation to respect is found the duty to include the right to food in human rights law and realization of the right to food in development objectives, as well as enacting legislation aimed at realizing the right to food, e.g. equal access to food production resources through agrarian reform, etc. It also means abstaining from any deprivation of food. Protection includes investigating and punishing any acts resulting in deprivation of food.

The obligation to ensure includes incorporating specific targets according to resource availability to raise nutritional levels (quantified objectives); eradication of hunger; and providing adequate food for all. Ensuring also means adopting national food legislation and strategy to secure progressive implementation of the right to food, and to monitor compliance with existing laws, sanctioning violations when they occur. In other words, states should respect the necessary freedom and the resource base controlled by peoples or individuals; they should protect the freedom and the resource base against others; and the state should when necessary assist to fulfil the right to food when individuals by themselves, cannot take care of their own needs.⁽¹⁷⁾ Finally, it should be recalled that article 23 of the Covenant calls for "international action for the achievement of the rights recognized" in it. There is thus an element of transnational obligations towards the populations of countries whose right to adequate food may be favorably or adversely affected by the policies of a state or towards states which lack the necessary resources to alleviate hunger.

Most recently, the United Nations Convention on the Rights of the Child⁽¹⁸⁾ included in its article 24 a recognition of the right of the child to enjoyment of the highest attainable standard of health. In this regard, the States Parties agree to take appropriate measures,

c) To combat disease and malnutrition; including within the framework of primary health care, through, *inter alia*, the application of readily available technology and through the provision of adequate nutritious foods and clean drinking-water, taking into consideration the dangers and risks of environmental pollution.

(17) For further details of the obligations to respect, protect and fulfil, see A. Eide and P. Alston, "Advancing the Right to Food in International Law" in Eide, *supra* n. 1, at 249-259.

(18) Convention on the Rights of the Child, adopted by the General Assembly on 5 December 1989, A/RES/44/25.

Among regional human rights instruments, only the Inter-American Protocol to the American Convention on Human Rights contains a right to food. Its article 12 provides:

1. Everyone has the right to adequate nutrition which guarantees the possibility of enjoying the highest level of physical, emotional and intellectual development.

2. In order to promote the exercise of this right and eradicate malnutrition, the States Parties undertake to improve methods of production, supply and distribution of food, and to this end, agree to promote greater international cooperation in support of relevant national policies.

The African Charter on Human and Peoples' Rights omits the right to food, proclaiming generally only "the right to enjoy the best attainable state of mental and physical health".

Apart from conventional norms, the right to food has been reaffirmed in international declarations, resolutions, and programs of action, such as the Universal Declaration on the Eradication of Hunger and Malnutrition adopted in 1974 by the U.N. World Food Conference.⁽¹⁹⁾ The Declaration recognizes a grave food crisis and the inalienable right to be free from hunger and malnutrition. It stresses the need for structural changes to remove obstacles to food production and states that it is a fundamental responsibility of governments to cooperate for increased food production and equitable distribution of food. In a more limited context, the U.N. Standard Minimum Rules for the Treatment of Prisoners guarantees prisoners convicted of crimes "food of nutritional value adequate for health and strength, of wholesome quality and well prepared and served".

Discussions of the right to development also have touched upon food rights, as in the 1981 report of the U.N. Secretary General which mentioned the need for agrarian reforms aimed at social justice.⁽²⁰⁾ The Declaration on the Right to Development adopted by the U. N. General Assembly in 1986 also calls upon states to take measures to ensure equality of opportunity for all in their access to food.⁽²¹⁾

In addition to statements in human rights instruments, international organizations seeking to alleviate hunger have been created, most importantly the Food and Agriculture Organization established in 1945.⁽²²⁾ The Charter of the FAO pro-

(19) Universal Declaration on the Eradication of Hunger and Malnutrition, adopted 16 November 1974 by the World Food Conference, endorsed by the General Assembly in Res. 3348 (XXIX) of 17 December 1974.

(20) Cited in R. Plant, "The Right to Food and Agrarian Systems: Law and Practice in Latin America", in P. Alston and K. Tomasevski, *supra* n. 1, at 191.

(21) United Nations Declaration on the Right to Development, article 8(1), G.A. Res. 41/128 of December 4, 1986.

(22) For a discussion of the work of FAO in regard to the right to food, see J. Traylor, "FAO and the Right to Food", in Eide, *supra* n. 1, at 187-212.

vides that its mission is to promote investment in agriculture, better soil and water management, improve yields of crops and livestock, incite the transfer of technology to, and the development of agricultural research in, developing countries. In 1965 the FAO Constitution was amended to add to its purposes that of ensuring humanity's freedom from hunger. During its early years, the main focus of the FAO was on restoring productivity and making food supplies available to countries devastated by World War II. Later, technical assistance to developing countries became a major focus. In 1981 the FAO developed and proclaimed the World Soil Charter, discussed further below.⁽²³⁾

Still, it seems that the right to food has been treated by the United Nations largely as aspirational or programmatic, a goal to be achieved through economic growth, possibly because achieving effective implementation of the right to food is extremely complex, raising issues of commodities agreements, terms of trade, land reform, and equitable domestic and international distribution of available resources. Few issues are as politically threatening to governments as hunger. In addition, despite reiteration of the indivisibility and interdependence of all human rights by the United Nations, there remain challenges to the idea that economic rights form part of human rights.⁽²⁴⁾

Perhaps because of these factors, relatively few states have incorporated the right to food into domestic constitutional provisions or legislation, probably deeming policies favoring a right to work and the right to social security as adequate to deal with hunger and malnutrition. However, apart from its role in creating social expectations and perceptions, legislation can be necessary to provide for action during periods of acute food shortage. According to the FAO, such actions may include declaring a food emergency, requisitioning food stocks; requisitioning packaging material; mobilizing transport and storage facilities; facilitating handling and storage; and introducing and administering statutory rationing.⁽²⁵⁾

III. Environmental Protection and the Right to Food

Since the Green Revolution of the 1950s and 1960s, there has been increasing awareness that all regions of the globe are faced with problems of environmental degradation of the agricultural resource base. New technologies risk new forms of pollution and existing industries most heavily reliant on environmental resources and most environmentally harmful are rapidly growing in the developing

(23) FAO Doc. C81/27, October 1981, reprinted in *8 Envtl Pol. & Law* 63 (1982).

(24) See the discussions of this problem in United Nations, *Right to Adequate Food as a Human Right*, supra n. 1 at 10-16; and G.J.H. van Hoof, "The Legal Nature of Economic, Social and Cultural Rights: A Rebuttal of Some Traditional Views", in P. Alston and K. Tomasevski, supra n. 1, at 97-110.

(25) Spitz, "Livelihood and the food squeeze", *CERES*, May-June 1981, at 30.

world.⁽²⁶⁾ Deforestation by highland farmers causes flooding on lowland farms, within and across borders; pesticides and other hazardous chemicals enter the food chain and are internationally traded; marine pollution destroys fishing resources; and good land is turned to desert through overuse of fragile soil.

The ability of land to produce food is limited by soil and climatic conditions and by management techniques. Efforts to push production beyond natural limits only results in decreased productivity. Inappropriate measures for intensifying production on existing agricultural lands can lead to erosion, salinity, alkalinity, waterlogging, depletion of plant nutrients, deterioration of soil structure, desertification and pollution. Such degradation is often irreversible. Without corrective measures, 20 percent of the productive capacity of land in developing countries may be lost by the end of this century.⁽²⁷⁾ Moreover, measures to bring more land into cultivation can risk long term consequences to the climate through reduction of forests and grasslands. In spite of calls in the World Soil Charter for bringing into cultivation new lands, it is not clear that there is much additional land appropriate for cultivation. What little is left to cultivate is largely contained in rain forests which must be preserved to maintain the global ecological balance.

During 1990 and 1991, the situation was particularly grim. The global economy exacerbated chronic problems of heavy debt and low world prices for agricultural commodities.⁽²⁸⁾ Overall agricultural production showed a slight increase of 1.5%, but this represented a slowdown over growth rate for the prior year and the 1985-90 average.⁽²⁹⁾ For some areas, the picture was even more alarming. In Africa per capita real income in 1991 was below levels of the early 1970s and all but nine of 45 sub-Saharan countries had declining food production for the year. Seventeen countries are facing serious food shortages. In Latin America and the Caribbean food and agricultural production in the region fell well below population growth in both 1989 and 1990. A majority of Asian countries also failed to increase their food production in 1990.

The debt load of most tropical countries has made them increasingly dependent on imported food to meet the basic needs of rising populations. Development and technology transfer emphases have been inappropriate to the cultural needs and resource base of many receiving countries. Crop yields are dependent on costly imported inputs, generating a massive shift to cash crops to generate the income to purchase the inputs. The result is less land used for growing basic food crops, especially the best agricultural land. Food imports have risen dramatically, hunger in the rural areas has increased, and the movement of farmers to urban centers has grown,

(26) *Our Common Future*, Report of the World Commission on Environment and Development, 1985, pp. 4-5.

(27) Forward, World Soil Charter, FAO, 1982.

(28) FAO, *The State of Food and Agriculture 1991*, C91/2. August, 1991.

(29) *Id.*

as have those who move onto less productive marginal land or areas of uncut tropical forest due to the shift to export crops.

The policies and practices of developed countries with respect to resource use also represent long-term threats to the sustainability of developing countries' agricultural systems. These practices include subsidizing agricultural production, treating it like a utility and regarding a high level of national self-sufficiency as attainable and desirable. This destroys potential export markets and encourages developing country dependence on surplus food-grain exports.

The growing crisis has provoked response. The 1987 report of the World Commission on Environment and Development emphasized the central necessity of agricultural sustainability. As it noted, increasing agricultural, forestry and fishery output at the cost of degraded soil, deforestation and depleted fish stocks, threatens increased deprivation of the right to food in the future.

In 1988, the FAO Council adopted a definition of sustainability in relation to food and agriculture:

Sustainable development is the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.⁽³⁰⁾

Sustainability is a key element in FAO's 1982 World Soil Charter. Noting that land, comprising soil, water and associated plants and animals, is among the major resources available for man, the Charter states that use of these resources should not cause their degradation or destruction because human existence depends on their continued productivity. The Charter calls for promoting optimum land use, maintaining and improving soil productivity and conserving all soil resources. It particularly states that decisions about the use and management of land and its resources should favor long-term advantage rather than short-term expedience that may lead to exploitation, degradation and possible destruction of soil resources. Action guidelines include developing land use policies and incorporating their principles into appropriate resource legislation; developing an institutional framework for monitoring and supervising soil management and soil conservation; assessing lands for appropriate uses; implementing educational and research programs and disseminating information about soil erosion, management and conservation; and striving to create socio-economic and institutional conditions favorable to rational land resource management and conservation.

(30) FAO, *The State of Food and Agriculture, 1989*, p. 65.

What are the major problems currently threatening sustainable food production?

First, on a global level there is growing consensus that human activities are causing climatic change. Global warming threatens to disrupt agriculture in many parts of the world. Impact of the greenhouse effect is expected to be the greatest in semi-arid regions of Africa where the hotter days would aggravate famine and drought; humid, tropical parts of Asia where high sea levels would increase risk of flooding; and high latitudes of Alaska, Canada, and Scandinavia where more extensive ice thaws would cause serious problems.

Second, there is the loss of genetic resources.⁽³¹⁾ During human history, it is estimated that over 100,000 edible plant species have been used. This genetic diversity adds to the stability of production and restricts human vulnerability to plant disease epidemics. Today, population growth and the rising demand for food has reduced genetic diversity to where barely 150 plant species and 15 types of livestock are in widespread use. Most of the world population depends upon only 12 plant species for the major part of its food intake. Genetic engineering can improve strains, but the risks of scientific uncertainty are great. It may be a matter of concern that large agrochemical companies are among the leaders in plant biotechnology.

Third, as further discussed below, there is widespread use of agricultural systems and technologies that are not sustainable. These include the heavy use of mineral fertilizers, intensification of livestock production and the use of pesticides.

On a regional level, world fish stocks exploited within national fishing zones are under increasing pressure. Potential demand by the year 2000 approaches the upper limits of the potential for increased production. Acid rain also affects both managed and natural ecosystems, primarily in North America and Europe.

Within countries, on national and local levels, uncontrolled forest clearance, soil erosion and other forms of resource degradation affect agricultural production. Coupled with increased population pressures and pollution from industrial activities, there are problems posed for the longterm survivability of nations. There are some countries whose projected population for the year 2000 exceeds their productive capacities, even assuming full use of arable land and maximum use of currently available technology.

Whether looking at the food problem from a global, regional or national level, the three most widespread environmental challenges are (1) pesticide resistant pests; (2) soil, groundwater, surface water, and food contamination by

(31) FAO has established a global system for the conservation and utilization of plant genetic resources, composed of a Commission, and international undertaking and an international fund. The International Undertaking on Plant Genetic Resources, adopted in 1983 at the Twenty-second session of the FAO Conference in Res. 8/83, has been accepted by 104 countries.

mineral fertilizers, livestock wastes and pesticides; and (3) erosion, compaction and other forms of soil degradation.

1. Pests and Pesticides: The first book which created general public awareness of environmental problems was Rachel Carson's *The Silent Spring*. It concerned the use of the pesticide DDT. Since that time, crop intensification has led to increased pest problems and further use of pesticides, leading to disruption of ecosystems due to the death of non-target species, accumulation of pesticide residues in the environment and in food, and the buildup of pesticide resistance in target species. Since the 1940s, over 1600 species have developed significant resistance to major pesticides because of their long-term and non-selective use. In addition, the non-selectivity of the pesticides leads to eradication of natural enemies of the pests being fought. It is necessary now to seek understanding of the population dynamics of host-pest-predator.

Pesticides also directly affect the health of agricultural workers and food consumers through acute and chronic work-related exposure and chronic low-level exposure through consumption of residues in food. Acute poisoning of farm workers is the primary danger including problems of neurotoxicity, dermatological lesions, immune system incompetence and carcinogenicity. There is an urgent need to continue surveillance and assessment of pesticides.⁽³²⁾ In general, use of biocides must be targeted to meet criteria of low mammalian toxicity, limited persistence, and low environmental mobility.

2. Fertilizers and waste products: The high crop yields during the Green Revolution were the result in large part of high-energy inputs in the form of inorganic fertilizers, as well as pesticides and herbicides. The widespread rise in groundwater nitrate concentrations is related to the use of mineral fertilizers and is a particular problem in developed countries. With agriculture the principal user of water throughout the world, crop nutrients can accumulate in streams and underground aquifers. Moreover, many tropical soils are inappropriate for heavy fertilizer use due to rapid leaching of nitrogen. Yet, in spite of long term problems, fertilizer consumption in the developing countries continues to increase. There is an alternative: vegetables in rotation or as cover crops can supply some or all of the nitrogen required for crops. In addition, some nutrients leaving in the harvested crop or animal product can be recycled through processing wastes.

(32) In 1985 FAO adopted an International Code of Conduct on the Distribution and Use of Pesticides, Conference Resolution 10/85. The Code was amended in 1989 to include a requirement of prior informed consent to export to another country of any pesticides that are banned or severely restricted. Other parts of the Code of Conduct regulate pesticide management, testing, reducing health hazards, regulatory and technical requirements, availability and use, distribution and trade, information exchange, labelling, packaging, storage and disposal, advertising, and monitoring.

3. **Loss of soil:** 97% of the world's food is produced on land⁽³³⁾ and the problem of erosion is a global one. In the United States, the federal Department of Agriculture has found that 6.5 billion tons of soil per year are lost on nonfederal lands to wind and water erosion.⁽³⁴⁾ Others estimate that one-third of the topsoil of U.S. agricultural land has been lost over the past 200 years.⁽³⁵⁾ Soil degradation results from three main causes: chemical, including the accumulation of excess salts; physical, notably wind and water erosion; and biological, including deforestation and rangeland destruction through overgrazing. Although a clear assessment is difficult because of sparseness and non-comparability of available data, it appears that in some areas wind erosion has affected more than one-third of all land. The problem is exacerbated by intensive farming to meet population pressures. In a study of one country, maize yields showed declines over the past 25 years.⁽³⁶⁾ During this period, land pressure increased and fallow periods became impossible in many areas due to cropping every year. Soil organic matter declined and surface erosion became widespread. Soil nutrients are now removed by crops faster than they can be replaced. Without remedial action, farmers in such situations are caught in a downward spiral leading to poverty and deprivation.

Mismanagement is estimated to be responsible for over 80 percent of recent worldwide desertification. Human causes include increased human and livestock populations, overgrazing, bushfires, expansion of agricultural crops, and deforestation due to demands for firewood. Today some one-quarter of the Earth's land surface is desert or damaged by factors that lead to desertification. A further cause for alarm is the fact that the rate of desertification appears to be accelerating in some areas.

At the opposite extreme are areas with too much water, land that is waterlogged or excessively saline. The problem is often caused by water mismanagement and drainage problems. Some of the water problems, particularly flooding, are related to deforestation for the expansion of agriculture and the collection of fuelwood. Trade in wood products, sometimes blamed for deforestation, in fact accounts for only 6% of the use of wood globally.

All of these issues are closely linked to rural poverty, including the lack of access by poor households to productive resources sufficient to meet their basic needs. Population growth is leading to diminishing farm sizes and increasing fragmentation of holdings. New croplands are often marginal and some 300 million people survive each year by slash burn agriculture. The problem essentially and fundamentally remains one of increasing food production other than by expanding

(33) R. Lal, D.J. Eckert, et al., "Conservation Tillage in Sustainable Agriculture", *supra* n. 10.

(34) *Id.*

(35) *Id.*

(36) FAO, Maize Yields: Malawi, *The State of Food and Agriculture 1989*, pp. 72-73.

the land under cultivation. Population increase demands the former, environmental concerns demand the latter.

The problem is often one of now vs. then. The rural poor overexploit natural resources as a matter of survival, concerned with today's security rather than the future. Even so, food security is beyond the reach of many, creating a cycle of declining productivity. Changing current practices is difficult because long-term benefits of sustainable agricultural practices will not necessarily be reflected in the short term economic calculations of farmers. New practices and programs, both national and international, will have to provide the possibility of short term economic success.

IV. Some Suggestions

All parts of a farming system are interrelated, including the farmer and family.⁽³⁷⁾ It is important to achieve and maintain a biological balance in the agricultural system by maximizing desired biological relationships and minimizing the use of material and practices that disrupt the system. From the perspective of the plant, the key to sustainable agriculture is nutrient cycling. In an agricultural system, one large loss from the cycle is the harvested crop. The loss is minimized if crops are fed to animals and only animal products leave the farm, but this is not practical for most farms. Management practices can minimize other losses and inputs can offset the remaining ones.

The agenda is easier to state than to achieve: increase the utility of agriculture by maintaining adequate production while providing an adequate livelihood for producers; provide food of acceptable quality and diversity; increase productivity and maintain crop diversity while maintaining a favorable environment; conserve groundwater and protect it from contamination; reduce or eliminate use of pesticides and synthetic fertilizers; maintain wildlife stocks; assure indefinite evolution by minimizing soil loss from erosion and conversion to nonagricultural use; maintain genetic diversity; and develop beneficial patterns of geographical distribution and scale. Clearly some of these goals are in conflict and a balance will have to be reached through a holistic approach.

The major problem is to simultaneously increase rural incomes, alleviate hunger and conserve natural resources. This requires creating an economic and social environment that will encourage the adoption of new environmentally sound technologies and systems.

There are traditional, successful agricultural production systems which rely on crop rotation and biological diversity. Rotation of insecticides and herbicides,

(37) For an excellent and detailed discussion of current problems and possible solutions, see *Sustainable Agricultural Systems*, edited by C. Edwards, R. Lal, P. Madden, R.H. Miller and G. House. Soil and Water Conservation Society, Ankeny, Iowa, 1990.

even in continuous single crop cultures, also reduces the probability of pest resistance to chemicals. Studies of traditional agriculture are beginning to show the great value such systems have for contributing to the development of ecologically sound management practices that are understandable and acceptable to local populations.⁽³⁸⁾ The problem again is that many farmers are forced into crop specialization because of short-term economic necessity. They are locked into payment programs that make them dependent on cash grains, as they are caught between long-term soil fertility and short-term economic viability.⁽³⁹⁾

One important change can be further development of environmental accounting to treat natural resources such as water, land and forests like other forms of capital with an economic value reflected in price. This requires monitoring natural capital based on full inventories to be used for accounting purposes. While quantifying the value of a river or forest is difficult, failure to include them distorts the real costs of agriculture. Aside from the polluter pays principle, which reflects these costs to some extent, the World Bank concept of "marginal opportunity cost of resource depletion" may be considered. It incorporates the direct and indirect costs of resource degradation, as well as the benefits foregone by those who otherwise would have been able to use the resource in the future.

At the level of the individual farm, environmentally sound accounting could make use of "whole farm analysis". This approach looks at a farming method that may appear to be very profitable or otherwise advantageous per acre, per cow, or at the individual enterprise level, and tests it from the perspective of the whole farm or the household. Whole farm analysis considers the compatibility of proposed alternatives with various practices already in place, the farm's physical and biological resources and anticipated changes in crop yields, livestock enterprise productivity and production costs, the impact on labor and machinery requirements, and the size of the farming operation. Analysis at the whole farm level is essential in determining the economic suitability and sustainability of alternative farming practices but

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- (38) Studies have been done of polycultures of maize, beans and squash, practiced in Central America since prehispanic times and still an important part of the patterns of food production there. (Pinchinat, A.M., J. Soria, and R. Bazan, "Multiple cropping in tropical America", 1976, pp. 51-64, in R. I. Papendick, P. A. Sanchez, and G.B. Triplett, eds., *Multiple Cropping*. Special Publication 27, American Society of Agronomy. Madison, Wisconsin). A series of studies in Tabasco, Mexico showed that maize yields increased 50 percent above monoculture yields when planted with beans and squash. Amador, M. F., 1980, *Comportamiento de tres especies (Maiz, Frijol, Calabaza) en policultivos en la Chontalpa, Tabasco, Mexico*. Tesis Profesional. Colegio Superior de Agricultura Tropical, Cardenas, Tabasco, Mexico. Although there was some yield reduction for the associated crop species, the total yields for the three were higher than for an equivalent amount of land planted to monoculture. Apparently squash helps control weeds through its broad, thick, horizontal leaves. Insects also are at a disadvantage in the intercrop system.
- (39) See C. A. Francis and M. S. Cless, "Crop Rotations in Sustainable Production Systems" in Edwards, Lal et al, *supra* n. 10, at 107.

will clearly need a multidisciplinary team and the development of models before it can be widely implemented.

As for the right to food, it is perhaps the most "environmental" of the human rights. After all, agriculture is first and foremost a biological process. Implementation of the right to food demands the same techniques as does environmental protection: monitoring, impact assessment, public participation, etc. The links between human rights and the environment are perhaps most clearly seen in this area: without adequate food, the environment will deteriorate, because hungry people will have no alternative but to convert ecologically unique or necessary habitats into arable land. Thus, conservation of forests and wetlands, for example, depends upon solving the problem of increasing productivity of existing agricultural lands, while also reducing demand for food through slowing population growth. In turn, increased productivity necessary to satisfy the right to food demands environmentally sound measures to ensure sustainability of food supplies. In sum, food production is an environmental issue and, conversely, environmental protection is essential for guaranteeing the human right to food.