

**ELEMENTS OF A SUSTAINABLE AGRICULTURE STRATEGY
FOR THE
INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE**

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Background

The Development Strategies for Fragile Lands (DESFIL) project of USAID was asked by IICA to provide guidance in the establishment of an institutional program in Sustainable Agriculture. Financing of this initiative was provided jointly by ROCAP and IICA. To date activities have included:

- * A review of background materials on IICA programs.
- * Presentation of a workshop on sustainable agriculture with particular reference to the CGIAR experience with the maximum of interaction with IICA senior staff.
- * Interviews with the Director General and other senior staff to explore their individual interests and questions related to sustainable agriculture and IICA.
- * Preparation of a background materials to guide IICA in the formulation of a sustainable agriculture strategy.

This background effort is intended as a point of departure for IICA in defining more specific initiatives addressing the economic, social and biophysical aspects of sustainable agriculture.

Workshop Synopsis

A Definition - It was concluded that the definition of sustainable development presented in the Brundtland report (World Commission on Environment and Development, 1987) serves as an excellent conceptual framework for the development of a sustainable agriculture stance for IICA.

....To meet the needs of the present
without compromising the ability of
future generations to meet their own needs....

There are many other definitions of sustainable agriculture in the literature. A number of definitions, principally by economists, appear in the appendix at the end of this paper to illustrate the diversity and occasional divergence of views (Pezzey, 1989).

Institutional Focus - IICA serves 31 countries in the hemisphere through activities of the headquarters in Costa Rica, regional offices and offices in each of the member countries. The institutional focus is upon increasing agricultural productivity with a strong emphasis on policy. The principal clients are ministries of agriculture in each of the member countries. IICA's strength lies in its close ties with the member countries that provide budgetary support to the institution through their contributions. While the countries are concerned with immediate needs of the agricultural sector, the staff noted that IICA should be concerned as much with the needs of future generations and providing leadership in this area of sustainable agriculture.

Agricultural Reactivation - IICA is currently considering a "Plan of Joint Action for Agricultural Reactivation in Latin America and the Caribbean." The need for such a plan grows out of the recognition of the importance of agriculture in the Region and the obvious potential to make the agricultural sector more productive and economically viable. As this plan is formulated, special consideration will be given to efforts which can not only achieve short-term agricultural development goals but which can also insure that the Region will more nearly realize its significant potential for sustained, long-term agricultural development. To do this, IICA will give major attention to policies and programs which will help insure that agriculture in the Region is maintained in a sustainable, productive state -- consistent with the needs and goals of the countries within the Region.

Future Directions - IICA has determined that it will not establish a separate program in sustainable agriculture, rather the strategy will be to integrate its concepts as appropriate in five existing programs. Also decided a priori was that IICA would concern itself with sustainable agriculture strictly in the context of agricultural productivity, and not take on the broader concerns for natural areas, biodiversity or watershed management. It was noted that a clear relationship exists between achieving more sustainable agriculture and reduced stress on natural areas and renewable natural resources. A logical sequence in developing its sustainable agriculture focus appears to be:

- * Modification of IICA's Medium Term Plan to include Sustainable Agriculture
- * Screen existing projects for Sustainable Agriculture compatibility
- * Incorporate Sustainable Agriculture concepts in the design of new projects
- * Explore policy implications of Sustainable Agriculture

* Promote Sustainable Agriculture with ministries of agriculture

A RATIONALE FOR SUSTAINABLE AGRICULTURE

The Global Context

The next few decades present a greater challenge to the world's food systems than they may ever face again. The effort needed to increase production in pace with unprecedented increase in demand, while retaining the essential ecological integrity of food systems, is colossal, both in its magnitude and complexity. Given the obstacles to be overcome, most of them man-made, it can fail more easily than it can succeed.

This statement by a special panel of the World Commission on Environment and Development (WCED) presents a sobering appraisal of the challenge facing global food systems -- despite the significant advances made in food production in recent decades. For example, from 1950 to 1984, global cereal production increased approximately 2.6 fold -- from 624 million tons to 1,645 million tons. Even though there was a rapid rate of population growth during that period, per capita cereal production still went up some 40 percent.

Despite this unprecedented improvement in food production, there is growing concern that this rapid rate of progress cannot be sustained. Since 1984, per capita production of cereals worldwide has declined each year. During the past four to five years, food production has been essentially static in a number of countries such as India, Mexico, Indonesia and China -- countries which enjoyed phenomenal increases in cereal production as a result of "green revolution" technologies. Global grain reserves in 1989 are estimated to be at the lowest level since immediately after World War II.

The phenomenal Green Revolution in cereal production was achieved by relatively few of the world's farmers using technologies and grain varieties capable of efficiently utilizing purchased agricultural chemicals on the best land, often with irrigation. This technology, created by internationally funded centers, is not readily adapted to less favored lands nor to the majority of the rural population that has no land or insufficient land to produce a surplus under any available technology. Africa, and to a great extent Latin America, have been little influenced by the Green Revolution. Latin America has joined Africa during the 1980s as the second major region to experience a decline in food production per capita. Since 1981, Latin America's output of food per person has fallen some 10 percent, expanding still further the Region's food deficit.

This decline in per capita food production in Latin America as well as globally means, simply, that population is increasing more rapidly than food production. The arable land base of the earth is ultimately finite. In looking into the future, agriculture must provide the basis to feed some 90 million more people each year, worldwide. The enormity of this problem is highlighted by the fact that about 90 percent of the increase in population is occurring in the developing world where food deficits are already critical in some areas. On closer examination the problem is far more complex than simply a race between population growth and food production, particularly in Latin America. Among the factors contributing to lagging per capita food production are:

- * Land tenure patterns under which the majority of the rural population is concentrated on a small fraction of the arable land.

- * Land use patterns under which the majority of the best arable land is not used for food production, but rather is used for export crops or extensive grazing.

- * Lack of access by the majority of the rural population to extension services, credit, material inputs, or basic education, health and family planning services.

- * An array of policies affecting commodity prices, land use intensification, land titling and rural infrastructure investments that discriminate against small food producers.

These same factors contributing to lagging food production often contribute to natural resource degradation as well. For example, the growing population without access to productive land and services are clearing fragile lands incapable of sustaining traditional agriculture. Poor farmers deprived of appropriate agricultural extension services contribute to widespread erosion. The rate of loss of biologically diverse natural areas is compounded by the expansion of subsidized cattle ranching and land titling policies which require the clearing of lands unsuitable for agriculture.

Intensification of traditional agricultural systems to meet growing needs has often had undesirable environmental or ecological consequences. Increased demand for fuelwood as well as increased need for agricultural areas to cultivate have resulted in major problems of deforestation and related soil degradation. Growing food needs have forced farmers to clear and cultivate hillsides and other fragile lands, resulting in a severe erosion and loss of productivity. In many areas, water reserves are being seriously depleted. The forage needs of livestock in many developing countries now exceeds the carrying capacity of grasslands -- in some areas by as much as 50 - 100 percent. This results in the deterioration

of rangelands, often leading to desertification. Air, soil and water are being contaminated by the waste products of industry, urban development and some agricultural practices. The global warming trend, the long-term effects of which are still uncertain, could have enormous effects upon food production capabilities in many parts of the world.

These are some of the circumstances which have led to increasing concern over the ability of global agricultural systems to produce sustainable levels of food.

Sustainable Agricultural Development

The report of the World Commission on Environment and Development, known as the Brundtland Report, has focused major attention on this problem -- encouraging the achievement of sustainable development (WCED, 1987). Applied to agriculture, this might be characterized as "development that meets the (agricultural) needs of the present without compromising the ability of future generations to meet their needs (for agricultural products)." This is a dynamic concept which recognizes that, globally, agriculture must do far more than maintain current levels of production. Indeed, productivity must increase to accommodate steadily growing demands from an expanding world population. Efforts to meet this demand without compromising the capability of future generations to meet their needs must include vigorous programs to control population growth as well as adoption of sustainable agriculture practices.

Sustainable agriculture is not synonymous with low input agriculture. Poor farmers are obligate users of few inputs. Among the approaches to reducing the spread and acceleration of resource deterioration and increasing poverty is to increase the access to, and use of, off farm inputs such as fertilizers. International agricultural research centers are now exploring how to increase the efficiency of use of limited resources available to small farmers on less favored sites.

Intra and inter-generational equity are both integral concerns in sustainable agriculture. The two concerns are intimately linked. When a large proportion of today's rural population in developing countries lack access to land and services, not only is food production suppressed, but those eking out an existence cause dramatic resource degradation. This in turn threatens the resource base of future generations.

Constraints to Achieving Sustainable Agriculture Objectives

There are many problems or constraints which limit the achievement of sustainability objectives. First and perhaps foremost is population growth. Unless this is controlled, the task will be very difficult, if not impossible. A second major issue is the amount of land available to expand cultivated areas. While this would

appear to be sufficient for the foreseeable future, a variety of circumstances make it very difficult to develop and use much of this land effectively. Many experts believe, therefore, that new areas brought into cultivation will do little more than compensate for the loss of agricultural land diverted to other use and otherwise lost through various processes of degradation such as erosion, salinization, desertification and other factors. The growing global demand for agricultural production must, therefore, be met primarily by intensification of production on land already under cultivation.

There are many physical, biological, economic, social, and political problems which constrain or limit the achievement of sustainability goals. These problems include soil erosion, water pollution, agricultural pests and diseases, pesticide resistance and toxic effects, loss of protective watersheds, crop pests and animal diseases, desertification, government policies unfavorable to agriculture, weak research, extension and educational institutions, inadequate laws and regulations protecting natural resources, political instability, and many others. These circumstances are treated in detail in several current publications relating to the subject (e.g., the report of the World Commission on Environment and Development, the report on Sustainable Agriculture by the Technical Advisory Committee of the Consultative Group on International Agricultural Research (FAO, 1988), and others).

IICA's Sustainable Agriculture Strategies

As IICA develops activities in its five Program areas and in its Plan of Joint Action for Agricultural Revitalization in Latin America and the Caribbean, consideration will be given to incorporating sustainable agricultural concepts and objectives into such a plan. Specifically, as actions are taken to revitalize and accelerate the development of agriculture in the Region, consideration will be given how this can be done in a sustainable manner - i.e., how short-term agricultural development objectives can be achieved without jeopardizing or compromising the ability of the Region to meet future long-term goals and needs. Special emphasis will be placed on maintaining or enhancing the quality of the environment and conserving the natural resource base on which agriculture depends. Decreasing agricultural productivity, deterioration of fragile lands, and deforestation are closely related to the lack of access to productive resources including land, credit, technology and education by the poor majority.

This suggests a flexible approach. The implementation of sustainable agriculture programs for poor hillside farmers, underutilized/over-grazed lands, and high input export agriculturists would require far different strategies. Priorities and approaches need to be established to meet the tremendously broad range of needs both among and within the countries served by IICA.

To carry out such commitment will not require a separate program within IICA, dealing specifically with sustainable agriculture. All five of the current program areas in IICA deal with problems or issues having significant sustainability implications. Each of the five major programs has the potential capability to address many of the sustainability-related problems or constraints and, by so doing, contribute to the achievement of sustainability goals. This means that sustainability concerns will be reflected in and made an integral part of the process of planning, executing and evaluating many of the efforts related to agricultural development in the Region.

For example, as the Plan of Joint Action for Agricultural Revitalization is implemented, efforts will be made to incorporate a sustainability perspective into the various facets of the Plan. As a part of the Plan, consideration will be given to the activation of specific projects that will address important sustainability issues. IICA's Medium Term Plan will also be modified to reflect the commitment to sustainability.

IICA will give major emphasis to sustainability considerations in the planning and execution of projects and programs under its immediate jurisdiction. Moreover, IICA will also provide assistance to its member states as they address sustainability-related issues. Because of its close ties with the governments in the Region, IICA is in a unique position to give leadership and assistance to the member states as they deal with this matter.

The report of the World Commission on Environment and Development suggests a wide range of strategies for achieving sustainable agricultural development. Following are examples of suggested strategies to deal with specific issues:

- * Government Intervention. "In general, patterns of government intervention suffer three basic defects. First, the criteria that underlie the planning of these interventions lack an ecological orientation and are often dominated by short-term considerations. These criteria should discourage environmentally unsound farm practices and encourage farmers to maintain and improve their soils, forests, and waters.

"The second defect is that agricultural policy tends to operate within a national framework with uniform prices and subsidies, standardized criteria for the provision of support services, indiscriminate financing of infrastructure investments, and so forth. Policies that vary from region to region are needed to reflect different regional needs, encouraging farmers to adopt practices which are ecologically sustainable in their own areas.

"The third defect in government intervention lies in incentive structures. In industrialized countries, overprotection of farmers and overproduction represents the accumulated results of tax reliefs, direct subsidies, and price controls. Such policies are now filled with contradictions that encourage the degradation of the agricultural resource base and, in the long run, do more harm than good to the agricultural industry. Some governments now recognize this and are making efforts to change the focus of subsidies from production growth to conservation.

"On the other hand in most developing countries, the incentive structure is weak. Market interventions are often ineffective for lack of an organizational structure for procurement and distribution. Farmers are exposed to a high degree of uncertainty, and price support systems have often favored the urban dweller or are limited to a few commercial crops, leading to distortions of cropping patterns that add to destructive pressures on the resource base. In some cases, price controls reduce the incentives to produce. What is required in many cases is nothing less than a radical attempt to turn the "terms of trade" in favor of farmers through pricing policies and government expenditure reallocations.

"Strengthening food security from global point of view requires reducing incentives that force overproduction and noncompetitive production in the developed market economies and enhancing those that encourage food production in developing countries. At the same time, these incentive structures must be redesigned to promote farming practices that conserve and enhance the agricultural resource base."

Trade. "Countries must recognize that all parties lose through protectionist barriers which reduce trade in food products where some nations may have genuine advantage. Nations must begin by redesigning their trade, tax, and incentive systems using criteria that include ecological and economic sustainability and international comparative advantage."

The Resource Base. "Agricultural production can only be sustained on a long-term basis if the land, water, and forests on which it is based are not degraded. Public intervention will be often necessary to provide a framework for this. But more specific policies that protect the resource base are needed to maintain and even enhance agricultural productivity and the livelihood of all rural dwellers."

Land Use. "The initial task in enhancing the resource base will be to delineate broad land use categories...."

Classifying land according to best use will determine variations in infrastructure provisions, support services, promotional measures, regulatory restrictions, fiscal subsidies and other incentives and disincentives."

Water Management. "Improvements in water management are essential to raise agricultural productivity and to reduce land degradation and water pollution. Critical issues concern the design of irrigation projects and the efficiency of water use.

"Where water is scarce, irrigation projects should maximize productivity per unit of water; where water is plentiful, it must maximize productivity per unit of land. But local conditions will dictate how much water can be used without damaging the soil. Salinization, alkalinization, and waterlogging can be avoided by more careful approaches to drainage, maintenance, cropping patterns, the regulation of water quantities, and more rational water charges.

"In some areas, excessive use of ground water is rapidly lowering the water table. Where ground water use exceeds the recharge capacity of local aquifers, regulatory or fiscal controls will become essential."

Chemical Use. "Many countries can and should increase yields by greater use of chemical fertilizers and pesticides, particularly in the developing world. But countries cannot so improve yields by helping farmers use organic nutrients more efficiently. Hence, governments must encourage the use of more organic plant nutrients to complement chemicals. Pest control must also be based increasingly on the use of natural methods. These strategies require changes in public policies....Developing countries must possess the basic legislative and institutional instruments to manage the use of agricultural chemicals within their countries."

Forestry and Agriculture. "Forests protect watersheds, reduce erosion, offer habitats for wild species and play key roles in climatic systems. They are also economic resources providing timber, fuelwood and other products. The crucial task is to balance the need to exploit forests against the need to preserve them.

Human Resources.

"The technological transformation of traditional agriculture will be difficult without a matching effort to develop human resources. This means educational reforms to produce researchers more attuned to the needs of rural people in agriculture. Illiteracy is still widespread among the rural poor. But efforts to

promote literacy should focus attention on functional literacy covering the efficient use of land, water and forests.

"Despite women's critical role in agriculture, their access to education and their representation in research, extension and other support services is woefully inadequate. Women should be given the same educational opportunities as men. There should be more female extension workers and women should participate in field visits. Women should also be given more power to make decisions regarding agricultural and forestry programs."

Land Reform. "In many countries where land is very unequally distributed, land reform is a basic requirement. Without it, institutional and policy changes meant to protect the resource base can actually promote inequalities by shutting the poor off from resources and by favoring those with large farms who are better able to obtain the limited credit and services available. By leaving hundreds of millions without options, such changes can have the opposite of their intended effect, insuring the continued violation of ecological imperatives.

"Given the institutional and ecological variations, a universal approach to land reform is impossible. Each country must work out its own program of land reform to assist the land poor and to provide a basis for coordinated resource conservation. The redistribution of land is particularly important where large estates and vast numbers of the land poor coexist. Crucial components include the reform of tenancy arrangements, security of tenure, and the clear recording of land rights. In agrarian reform, the productivity of the land and, in forest areas, the protection of forests should be a major concern."

The above excerpts from the report of the World Commission on Environment and Development provide examples of possible strategies which IICA might consider in dealing with sustainability-related issues. IICA will consider these and other ideas in formulating specific strategies for programs to address sustainability matters.

The Importance of Agricultural Sustainability

It has been suggested that "sustainability is important because the future is important." Certainly, efforts to achieve sustainability in agriculture directly reflect a concern for the future. Such a concern emphasizes IICA's unique role and mission. Many developing country governments are more concerned with immediate, short-term problems or issues and often have difficulty in developing policies and strategies for the longer term future. Yet it is vitally important that there are those who are concerned about the future

and who will encourage policies and programs that help assure that there is a future for our planet and the people on it. There is great need for an organization like IICA to concern itself with longer-term issues, helping member governments to give appropriate attention to such issues.

The challenge facing IICA and its member countries is to find ways of removing the impediments to sustainable agricultural production, whether the causes are technical, economic, social, institutional, political, or some combination of all. Accepting this challenge offers IICA an opportunity to make unprecedented contributions not only to the Region but also to global community through efforts to find solutions to serious problems that threaten the future welfare of humanity.

Sustainable agriculture implies the integrated consideration of social, technical and economic factors by experienced professionals. That agriculture is a sector in a broader context of sustainable development considering also urban-industrial and natural areas.

The consideration of land capability is critical in the formulation of policies and projects in sustainable agriculture. Resource deterioration can often be traced to over and under-utilization of the land. The sustainability of land titling, colonization, concessions, subsidies, and management schemes are all vitally influenced by land capability.

Grupo Interamericano

Eduardo Trigo, head of the Technology Generation and Transfer Program of IICA, proposed that IICA sponsor an Inter-American Discussion Group on Environment and Sustainable Agriculture. This group would have a permanent technical secretariat and dedicate itself to meetings and studies on broad issues related to sustainable agriculture in the hemisphere.

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APPENDIX 1 DEFINITIONS OF SUSTAINABILITY IN THE LITERATURE

This Appendix is not exhaustive, but it gives a good idea of the variety of definitions of sustainability concepts that have appeared in the last decade, and of the people who use such concepts. (Bold type is added where appropriate to emphasise which concepts are being defined.)

Allen (1980) - summarising IUCN (1980)

1. "Sustainable utilization is a simple idea: we should utilize species and ecosystems at levels and in ways that allow them to go on renewing themselves for all practical purposes indefinitely." (p18)
2. "The importance of ensuring that utilization of an ecosystem or species is sustainable varies with a society's dependence on the resource in question. For a subsistence society, sustainable utilization of most, if not all its living resources is essential. ... The greater the diversity and flexibility of the economy, the less the need to utilize certain resources sustainably, but by the same token the less the excuse not to." (p18)
3. "...it is essential...to ensure that...people protect those parts of the biosphere that need protecting and modify the rest only in ways that it can sustain." (p20)
4. "sustainable development - development that is likely to achieve lasting satisfaction of human needs and improvement of the quality of human life" (p23)

Barbier (1987) - academic economist

1. "...the concept of sustainable economic development as applied to the Third World...is therefore directly concerned with increasing the material standard of living of the poor at the 'grassroots' level, which can be quantitatively measured in terms of increased food, real income, educational services, health-care, sanitation and water supply, emergency stocks of food and cash, etc., and only indirectly concerned with economic growth at the aggregate, commonly national, level. In general terms, the primary objective is reducing the absolute poverty of the world's poor through providing lasting and secure livelihoods that minimize resource depletion, environmental degradation, cultural disruption and social instability." (p103)

Brown et al (1987) - environmental scientists

1. "In the narrowest sense, global sustainability means the indefinite survival of the human species across all the regions of the world. A broader sense of the meaning specifies that virtually all humans, once born, live to adulthood and that their lives have quality beyond mere biological survival. Finally the broadest sense of global sustainability includes the persistence of all components of the biosphere, even those with no apparent benefit to humanity." (p717)

Burness and Cummings (1986) - academic economists

1. "Professor Daly's notion of "sustainability" [in Daly 1986] is extraordinarily vague and ill-defined. ...in a pedagogical sense sustainability requires that all processes operate only at their steady state, renewable level, which might then suggest a return to a regulated caveman culture." (p323)

Clark (1986) - environmental scientist and policy analyst, IIASA

1. "A major challenge of the coming decades is to learn how long-term, large-scale interactions between environment and development can be better managed to increase the prospects for ecologically sustainable improvements in human well-being." (p5)

Coomer (1979)

1. "[The] sustainable society is one that lives within the self-perpetuating limits of its environment. That society...is not a 'no-growth' society. ... It is, rather a society that recognizes the limits of growth...[and] looks for alternative ways of growing." (p1)

Daly - academic economist

1. "The market does not distinguish an ecologically sustainable scale of matter-energy throughput from an unsustainable scale, just as it does not distinguish between ethically just and unjust distributions of income. Sustainability, like justice, is a value not achievable by purely individualistic market processes." (1986, p320).

2. "By 'growth' I mean quantitative increase in the scale of the physical dimensions of the economy; ... By 'development' I mean the qualitative improvement in the structure, design and composition of physical stocks and flows, that result from greater knowledge, both of technique and of purpose." (1987, p323)

Georgescu-Roegen (1988) - academic economist

1. "...'growth' is if you get just an increasing number of the same type of mail coaches. And if you pass from traveling in mail coaches to traveling by railway, that is 'development'." (pS294)

Goodland and Ledec (1987) - institutional environmental scientists

1. "Sustainable development is here defined as a pattern of social and structural economic transformations (i.e. 'development') which optimizes the economic and societal benefits available in the present, without jeopardizing the likely potential for similar benefits in the future. A primary goal of sustainable development is to achieve a reasonable (however defined) and equitably distributed level of economic well-being that can be perpetuated continually for many human generations." (p36)

2. "...sustainable development implies using renewable natural resources in a manner which does not eliminate or degrade them, or otherwise diminish their usefulness for future generations.....Sustainable development further implies using non-renewable (exhaustible) mineral resources in a manner which does not unnecessarily preclude easy access to them by future generations..... Sustainable development also implies depleting non-renewable energy resources at a slow enough rate so as to ensure the high probability of an orderly societal transition to renewable energy sources....." (p37)

Howe (1979) - academic economist

1. "GUIDELINES FOR A RESPONSIBLE NATURAL RESOURCES POLICY

(6) "...activities should be considered that would be aimed at maintaining over time a constant effective natural resource base. This concept was proposed by Page (1977) and implies not an unchanging resource base but a set of resource reserves, technologies, and policy controls that maintain or expand the production possibilities of future generations." (p337)

Markandya and Pearce (1988) - academic economists

1. "The basic idea [of sustainable development] is simple in the context of natural resources (excluding exhaustibles) and environments: the use made of these inputs to the development process should be sustainable through time.If we now apply the idea to resources, sustainability ought to mean that a given stock of resources - trees, soil quality, water and so on - should not decline." (pp9-10).

2. "...sustainability might be redefined in terms of a requirement that the use of resources today should not reduce real incomes in the future...". (p11)

Morey (1985) - academic economist

1. "...much of the desertification literature also suggests that desertification is nonoptimal from both the producer's and society's perspective. Sustainable use is generally put forward as the optimal strategy." [Morey then shows how sustainable land use may or may not be optimal] (p551)

O'Riordan (1988) - academic environmental scientist

1. "It may only be a matter of time before the metaphor of sustainability becomes so abused as to be meaningless, certainly as a device to straddle the ideological conflicts that pervade contemporary environmentalism." (p29)

2. "Sustainability is a much broader phenomenon [than sustainable development], embracing ethical norms pertaining to the survival of living matter, to the rights of future generations and to institutions responsible for ensuring that such rights are fully taken into account in policies and actions." (p30)

Pearce - academic economist

1. "The sustainability criterion requires that the conditions necessary for equal access to the resource base be met for each generation." (1987, pl3).
2. "In simple terms [sustainable development] argues for (a) development subject to a set of constraints which set resource harvest rates at levels no higher than managed or natural regeneration rates; and (b) use of the environment as a 'waste sink' on the basis that waste disposal rates should not exceed rates of (natural or managed) assimilation by the counterpart ecosystems. . . . There are self-evident problems in advocating sustainable rates for exhaustible resources, so that 'sustainabilists' tend to think in terms of a resource set encompassing substitution between renewables and exhaustibles. Equally self-evident is the implicit assumption that sustainability is a 'good thing' - that is optimising within sustainable use rates is a desirable objective. On these terms, sustainability could imply use of environmental services over very long time periods and, in theory, indefinitely." (1988a, p58)
3. "The key concept [regarding natural resource degradation in developing countries] is 'sustainability'. Changes in resource management practice toward sustainable resource use could at least contribute to the preservation of the renewable resource base, and hence to the direct well-being of the population and to the future of the macroeconomy." (1988b, pl02)

Pearce, Barbier and Markandya (1988) - academic economists

1. "We take development to be a vector of desirable social objectives, and elements might include:
 - increases in real income per capita
 - improvements in health and nutritional status
 - educational achievement
 - access to resources
 - a 'fairer' distribution of income
 - increases in basic freedoms....Sustainable development is then a situation in which the development vector increases monotonically over time." (p4)
2. "We summarise the necessary conditions [for sustainable development] as 'constancy of the natural capital stock'. More strictly, the requirement as for non-negative changes in the stock of natural resources such as soil and soil quality, ground and surface water and their quality, land biomass, water biomass, and the waste assimilation capacity of receiving environments." (p6)

Pirages (1977) - from conference funded by the Institute for World Order

1. [Sustainable growth] means economic growth that can be supported by physical and social environments in the foreseeable future. An ideal sustainable society would be one in which all energy would be derived from current solar income and all non-renewable resources would be recycled." (pp10-11)

Porritt (1984) - Director, U.K. Friends of the Earth

1. "All economic growth in the future must be sustainable: that is to say, it must operate within and not beyond the finite limits of the planet." (p120)

Repetto (1985a) - economist, World Resources Institute. Also in Repetto (1986a), pp16-17

1. "The core of the idea of sustainability, then, is the concept that current decisions should not impair the prospects for maintaining or improving future living standards. ... This implies that our economic systems should be managed so that we live off the dividend of our resources, maintaining and improving the asset base. This principle also has much in common with the ideal concept of income that accountants seek to determine: the greatest amount that can be consumed in the current period without reducing prospects for consumption in the future." (p10)

2. "This does not mean that sustainable development demands the preservation of the current stock of natural resources or any particular mix of human, physical and natural assets. As development proceeds, the composition of the underlying asset base changes." (p10)

3. "There is broad agreement that pursuing policies that imperil the welfare of future generations, who are unrepresented in any political or economic forum, is unfair." (p11)

Redclift (1987) - academic economist

1. "...to what extent is economic growth an adequate measure of development?" (p15)

Solow (1986) - Nobel Prize academic economist

1. "...a society that invests in reproducible capital the competitive rents on its current extraction of exhaustible resources, will enjoy a consumption stream constant in time. ...this result can be interpreted as saying that an appropriately defined stock of capital - including the initial endowment of resources - is being maintained intact, and that consumption can be interpreted as the interest on that patrimony." (p141).

Talbot (1984) - former Director-General, IUCN

1. "OBJECTIVES OF THE WORLD CONSERVATION STRATEGY

Conservation has three basic objectives:

- (1) To maintain essential ecological processes and life support systems.
- (2) To preserve genetic diversity.
- (3) To ensure that the utilization of living resources, and the ecosystems in which they are found, is sustainable." (p4)

Tietenberg (1984) - academic economist

1. "The sustainability criterion suggests that, at a minimum, future generations should be left no worse off than current generations." (p33)
2. "Rather than eliminating the [positive] discount rate, the present-value criterion should be complemented by other criteria, such as sustainability. ...For example, we might choose to maximise present value subject to the constraint that future generations are not made worse off". (p432)

Tolba (1987) - Executive Director, U.N. Environmental Programme.

1. "[Sustainable development] has become an article of faith, a shibboleth: often used but little explained. Does it amount to a strategy? Does it apply only to renewable resources? What does the term actually mean? In broad terms the concept of sustainable development encompasses:
 - (1) help for the very poor because they are left with no option other than to destroy their environment;
 - (2) the idea of self-reliant development, within natural resource constraints;
 - (3) the idea of cost-effective development using different economic criteria to the traditional approach; that is to say development should not degrade environmental quality, nor should it reduce productivity in the long run;
 - (4) the great issues of health control, appropriate technologies, food self-reliance, clean water and shelter for all;
 - (5) the notion that people-centred initiatives are needed; human beings, in other words, are the resources in the concept." (p98)

Tonn (1988)

1. "Two principles of 500-year planning:
Principle 1: Future generations should not inherit, from present generations, unacceptable risks of death owing to environmental or other preventable catastrophes.
Principle 2: Future, as well as present, generations may inherit constraints on their primary freedoms as sacrifices for enjoying the conditions of Principle 1." (6th page of article)

Turner - academic economist

1. "The World Conservation Strategy...gave considerable prominence to the sustainability concept, although its precise meaning and practical applications were not presented in a detailed and operational form." (1987, p576)
2. "The precise meaning of terms such as 'sustainable resource usage', 'sustainable growth' and 'sustainable development' has so far proved elusive." (1988, p5).
3. "In principle, such an optimal [sustainable growth] policy would seek to

maintain an 'acceptable' rate of growth in per-capita real incomes without depleting the national capital asset stock or the natural environmental asset stock." (1988, p12)

4. "It makes no sense to talk about the sustainable use of a non-renewable resource (even with substantial recycling effort and reuse rates). Any positive rate of exploitation will eventually lead to exhaustion of the finite stock." (1988, p13)

5. "...in this [sustainable development] mode...conservation becomes the sole basis for defining a criterion with which to judge the desirability of alternative allocations of natural resources." (1988, p21).

WCED (1987) [Brundtland Report]

1. "We came to see that a new development path was required, one that sustained human progress not just in a few places for a few years, but for the entire planet into the distant future. Thus 'sustainable development' becomes a goal not just for the 'developing' nations, but for industrial ones as well." (p4)

2. "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- o the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- o the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs." (p43)

3. "Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation." (p43)

4. "Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. Yet many of us live beyond the world's ecological means, for instance in our patterns of energy use. Perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire." (p44)

5. "Economic growth and development obviously involve changes in the physical ecosystem. Every ecosystem everywhere cannot be preserved intact." (p45)

6. "The loss [i.e. extinction] of plant and animal species can greatly limit the options of future generations; so sustainable development requires the conservation of plant and animal species." (p46)

World Bank

1. "...satisfy the multiple criteria of sustainable growth, poverty alleviation, and sound environmental management." (1987, p10)
2. "To a large degree, environmental management should be seen as a means of attaining the wider objectives of sustained economic growth and poverty alleviation." (1987, p18)
3. "...elevating concern about environmental matters...and developing the capacity to implement sound practices for environmental management...are [both] needed to reconcile, and, where appropriate, make tradeoffs among the objectives of growth, poverty alleviation, and sound environmental management." (1987, p28)

ASSERTIONS OF ECONOMY-ENVIRONMENT INTERACTIONS

Allen (1980) - summarising IUCN (1980)

3. "development... depends upon conservation, and that conservation depends equally upon development." (p9)
4. "conservation of the biosphere is a prerequisite for human survival and well-being; ...interdependence is an inescapable fact of life." (p16)

Bartelmus (1986)

1. "...the overall goals of environment and development are not in conflict but are indeed the same, namely the improvement of the human quality of life or welfare for present and future generations." (pp13-14)

Clark (1986) - environmental scientist and policy analyst, IIASA

2. "Throughout most of history, the interactions between human development and the environment have been relatively simple and local affairs. But the complexity and scale of these interactions are increasing. ... What were once straightforward questions of ecological preservation versus economic growth now reflect complex linkages - witness the feedbacks among energy and crop production, deforestation and climatic change that are evident in studies of the atmospheric 'greenhouse' effect." (p5)

Tolba (1987) - Executive Director, UNEP

2. "...economic development and environmental quality are interdependent and, in the long term, mutually reinforcing. The rational management of the world's threatened natural resource base forestalls a loss in environmental quality and enhances sustainable economic growth." (p150)

WCED (1987)

7. "...it is impossible to separate economic development issues from environment issues; many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development. Poverty is a major cause and effect of global environmental problems." (p3)

World Bank

4. "Promoting growth, alleviating poverty, and protecting the environment are mutually supportive objectives in the long run. ... In the short run, however, the objectives are not always compatible..." (1987, p5)

5. "Poverty - of people and of countries - is thus a major cause of environmental degradation. That makes it essential, if environmental degradation is not to become completely unmanageable, to devise policies oriented toward economic growth, with special emphasis on improving the incomes of the poor. ... Nevertheless economic growth may also destroy the environment and further jeopardize the already tenuous lives of the poor. ... Thus, although growth is imperative for alleviating poverty, it may also adversely affect the poor and the environment if inadequate attention is paid to the poor and their needs." (1987, pp6-7)

6. "...economic growth, the alleviation of poverty, and sound environmental management are in many cases mutually consistent objectives." (1988, p1)