ENVIRONMENTAL MOTIVATION FOR INTERNATIONAL COOPERATION IN RESEARCH

I. INTRODUCTION

Over the last fifteen years, environmental and natural resources issues have become one of the central aspects of the international agenda. Until recently, environmental and natural resources degradation were taken as isolated events resulting from particular natural phenomenons or specific social or economic situations. Today there is an increasing awareness and agreement both among scientists and technical people as well as at the level of the policy makers about the globality of the problems and that the mismanagement of our natural resources is putting in danger the viability of the natural systems that support human life in our planet. The need for a new information and technological base for sustainable development is also widely recognized, however, there is still little in terms of specific actions to generate the new knowledge needed. In part this is due to inertia in research priority setting, both at the national and international level, and the weakness of national research infrastructures in the developing world. But also there are difficulties in fully comprehending the institutional and practical implications of the nature of the issues involved and how the globality of environmental and natural resources problems highlight the need for a new style of international cooperation in research and development.

In this paper we discuss some of the different dimensions associated with the setting up of international cooperation in environmental and natural resources research. The second section

briefly discusses the globality of the environmental dimension while the third looks into the factors affecting demand and supply of environmental quality in low and high income countries as a framework for research priorities setting and resource allocation in this field. The fourth section reviews the type of information needed both for decision making as well as technological development in this field, and the institutional situation, capabilities and limitations of research institutions in the Latin American countries. The fifth and final section offers some concluding remarks from the point of view of the contributions thus opportunities for international cooperation.

II. The Environment and the Economy: The Realities of Global Interconnected Systems 1/

Since the end of the second world war there has been a constant preoccupation with economic interdependence among nations;

1/ (This section is based on the following references: "Toward a Working Agenda for Sustainable Development" IICA, Program Papers Series # 25, September 1991; "Beyond Interdependence: The meshing of the World's Economy and the Earth's Ecology", J. NacNeill, P. Winsemius, T. Yakushiji, Oxford University Press (USA), 1991; "Food 2000: Global Policies for Sustainable Agriculture" Report to the WCED, Zed Books, London, 1987; and, Robert Repetto "Promoting environmentally sound economic progress: what the North can do". World Resources Institute, 1990.)

we are now moving to recognize that there is also ecological interdependence. The scant information that we have today about the dynamics of the ozone layer and global warming problems highlight the global nature of environmental problems and how cause-effect relationships go well beyond immediate environments. Of course, these relationships have always been there, however, in our time they have become more dramatic. Not only there is the fact that we know more about the nature of the involved relationships, but the incredible growth that the world has experienced during this century has taking the carrying capacity of many resources and ecologies to their limits. Urbanization and international trade have greatly magnified these relationships. Today cities and nations are interlocked in complex networks through which they access the services of ecological capital they depend upon for their subsistence and prosperity. Food for the population, energy and materials for their economies, and even land, air and water to assimilate their waste, do not come anymore from physical spaces confined by political boundaries but from far away regions within the countries or across nations. It is probably appropriate to speak of the existence of an international "shadow ecology" supporting today's societies. Economic growth and global trade mean that the concept of global "commons" should not only include the oceans and the atmosphere but also at least some portion of the land, forests, water and diversity that makes up each nation's ecological capital.

As we look into the future these problems and interrelations

will become more acute as the pressure on the resource base increases as a consequence of population growth and the expansion of economic activity needed to meet people's needs. Only in terms of food the needed effort will be monumental. According to the WCED the global food system must increase food production by 3 to 4 percent per year if the needs of an enlarged population are to be met. Interdependence will also grow as production possibilities and demand for food do not coincide, with agricultural potential been concentrated in a few mostly temperate and subtropical climate areas. This challenges will not be met without a large research and technological development effort. Even though economic, political, institutional, and social issues play a critical role in establishing new behavioral pattern in regards to environmental and natural resource conservation, it is uncontestable that without a significant change in the technological base of our societies it will be very difficult if no impossible to revert the current trend toward resource degradation. This effort should be undertaken as an international responsibility. The benefits of cleaner, safer technologies, which allow us to increase production with less from nature, are for all peoples and nations, the costs then should also be shared. Furthermore in many cases will be neither possible nor efficient to undertake the needed research as many countries lack the required scientific capabilities -and the problems are too acute to wait for their development- or the very nature of the problems calls for a broader approach.

In this context the Latin America and the Caribbean situation

is particularly complex. In the first place agriculture plays a critical role in the economic and social structure of the region, and as most countries move to reactivate and open their economies we can expect an intensification of agricultural activity. Because of the crisis reassuming a growth pattern is an absolute political priority, and with important comparative advantages in agriculture the region has a strategic role to play in this process, whether by producing food for a growing population or the raw materials needed to tap the dynamic potentials of agroindustry and timber industries, by generating the foreign exchange needed to balance the external accounts and reactivate the investment process, or by providing productive alternatives to the large segments of the rural poor that today are been forced to migrate to the already overcrowded and polluted cities. The challenge is how to do it equitably and without further endangering the long term productive capacity of the region's ecological capital. At the same time, many of the most important natural resources of the region are shared by more than one country. In South America, the Amazon, Orinoco, and La Plata basins virtually span the continent, with the exception of the Pacific coast. Likewise, the most important ecosystems not included in these basis, such as the Patagonia and the Andean highlands, are shared by two or more countries. In Central America, hillside areas are common in all the countries, and the humid Atlantic region extend from Panama to Mexico. Even the insular ecologies of the Caribbean are clearly interlocked through their dependence on oceanic resources.

The current sweeping trend toward greater political and economic integration will bring dramatic changes in land use systems and modify the nature environmental impact of agricultural activities -in fact of all economic activities- in a significant way. These processes, which are underway in all subregions, further reinforce the logic and need for environmental and natural resources research to be undertaken as a regional effort.

IV. INFORMATION AND RESEARCH NEEDS

The issues discussed above highlight the nature of the challenge that policy makers and researchers confront in the developing world in general and in LAC in particular. On the one hand there is a clear pressure to intensify agriculture and move to a higher productivity plateau; in some cases it will be the need to meet local food demands, in others the challenge to fully exploit natural comparative advantages in agriculture to reinitiate a growth pattern. If the transition hypothesis holds we can expect that in low income countries decisions will pay relatively little attention to environmental concerns in the technology choice to achieve these objectives. On the other hand, high income countries will tend to excert political and direct pressures -through funding restrictions, or non-tariff trade barriers based on environmental issues- for policies and agricultural production decisions to take into consideration the environmental impact dimension. Any move to reconcile these two perspectives confronts serious restrictions both in the availability of relevant information and in the research orientation and capabilities existing in less developed countries.

The Information Needs for Decision Making

A new outlook that reassesses the future and recognizes resource conservation and more sustainable production patterns as essential elements of the development model will require an information base that provides a better understanding of basic interrelationships within the biophysical systems, and between these and the socioeconomic and political systems. Such an

information base must also provide accurate data on specific aspects of the natural resource and environmental situation at any given moment (IICA 1991).

It is inevitable that a certain proportion of the natural resource base will be destroyed during the course of the production process. The key point here is that the decision about what are these costs must be made with full awareness of the environmental impact and future production options that will be eliminated and, consequently, of the nature and magnitude of the externalities and intergenerational transfers being made (Pearce 1989).

To convince decision makers that it will not always be possible to replace ecological capital or its services with man-made "capital" requires more than merely drawing up of a list of cases where it is impossible or where it can be only be imperfectly achieved. An understanding is required of the basic characteristics of the environment and of the dynamics whereby water, soils, climate and genetic resources interact with each other and within the different production systems used by human societies. A greater and deeper understanding of the phenomena - and the dangers- involved will eventually bring about the necessary changes in attitudes (ECLAC 1990a). Unfortunately, comprehensive data on environmental conditions and the interrelationships between production activities and those conditions are not available. In part this is due to the fact that the institutional structure relating to environmental and natural resources issues is rather new and in many cases still evolving but it is also true methods

and data collection systems are still lacking and/or in need of deep review.

A first priority is to reach an agreement on which indicators to use when analyzing the environment and natural resources. The indicators currently in use are incomplete and may often give rise to misinterpretations and erroneous policies (ECLAC 1990a). A good example is provided by indicators used to gauge the productivity of crops or the degree of agricultural pollution. Current indicators of productivity measure yield without taking into account the impact of production on the stock of resources. A more appropriate indicator would measure both input/output ratios and changes in the availability of resources (mainly land and water). This would be much more useful for decision making; for example, in making a choice between various technological options (Swaminathan 1989). As regards pollution, most indicators when available measure the level of use of chemical inputs and their effect on products, soils, water and air. They usually do not take into account contamination resulting from biological processes, such as swine production and coffee growing. Likewise, other indicators, such as those relative to the management of forestry reserves (forestation-deforestation), are too raw, and do not provide specific information (type of forest, species, etc.). Consequently, the information is not very useful for follow-up and decision-making purposes. Additionally, for a variety of reasons, much more information is available on temperate than on tropical zones. Since the consequences of environmental problems in the tropics

have a greater impact on the global environment, high priority must be given to developing indicators and gathering information on these regions (IICA 1991).

Directly related to the issue of indicators is the question of the social accounting systems currently in use. In general, these are incomplete, and do not incorporate variables relating to the environment and natural resources. Hence, the impact of different production activities on environmental resources is not correctly reflected in social accounts. These systems do not adequately taken into account depreciation and they consider the social costs of redressing environmental damage to be economic growth when calculating GDP. This distorts investment decisions and, even worse, favors those with the most negative impact on the environment and natural resources (Pomareda 1990).

New Research Orientations 1/

Independently of what advances might be made in changing values, institutions and policies, sustainable development will not become a reality unless a new technological path with a more benign impact on the environment and on natural resources is developed and implemented.

1/ This section draws heavily on "Toward a working agenda for sustainable agricultural development." 1991. Program Papers Series No. 25. IICA, San Jose.

Modern technology has made it possible to greatly increase the margins of security between production and subsistence. Traditional systems viewed resource conservation as a basic requisite for maintaining production levels (Gallopin 1989). Modern technology has relegated resource management technologies as a production strategy to a position of only relative importance. The most sophisticated example of this is the concept of the "Green Revolution," which provided for the intensive use of energy (agrochemicals, fertilizers, machinery). This approach is now at a crisis point, both because of growing concern over the high ecological cost of the intensive use of energy inputs and because the high prices of fuels and other petroleum products often make it economically unfeasible. In this context, the nature of the technological challenge in agriculture is clear.

Neither production nor productivity can be the variables which have to adjust. As we have stressed in the introduction in view of growing population pressure, and the increased demands on agriculture to reactivate the region's economies, long-term objectives cannot include major production cutbacks and must combine resource and environmental conservation with higher levels of economic activity and growth. This can only be achieved by means of a far-reaching technological transformation (Trigo 1990).

To meet this challenge, new research must be undertaken. While there is now a large stock of appropriate technologies from the economic, social and ecological standpoint for a significant number of the region's ecosystems, all too often research and

extension activities have focused on specific products and species, overlooking the interrelations that exist between them and the other elements of the ecosystem, which have considerable impact on farmers' behavior and decisions to adopt new procedures (Gallopin 1989). Thus, a first, critically important step will be to revise the processes and methods used for identifying research priorities and allocating resources, with a view to including the objectives of natural resource conservation and the promotion of sustainable agricultural development.

Within this framework, and without presuming to make an exhaustive analysis, we would suggest the following as some areas of immediate importance, some of which are clearly of a multinational dimension and present clear opportunities for international cooperation. The first area is general in nature and, to a certain extent, must be seen as the framework for all research efforts. It involves upgrading knowledge on the nature and behavior of the different ecosystems, as well as the indicators and data bases about the interactions agriculture -the environment- global changes for the major production systems in the region. This will improve the capacity of analyze the potential impact of different technological options from the point of view of their pollution and natural resources externalities and the capacity to follow up on their development once they have been applied. Here, advances in the fields of microelectronics and information sciences (simulation models, remote sensing, expert systems, data base management, etc.) open up a broad range of opportunities for

developing more realistic and efficient management plans.

The second area has to do with the utilization of the region's genetic resources. We have already stressed the importance of the biological diversity of the region and the fact that only a minimal amount is being used. A new strategy of sustainable agricultural production must incorporate genetic resources. First of all, it will be necessary to complete the inventories and evaluations of the resources currently available in the region; secondly, a re-evaluation should be made of the potential use of local resources which are well-adapted to the region and can be efficiently used in sustainable production programs, i.e. as substitutes for crops introduced from outside the region, many of which are extremely dependent on the use of agrochemicals. Making food accessible to the entire population is one of the most important components of any sustainable development strategy, and the region has a large enough genetic base that this should not pose any major problems. At present, however, most of the food produced and consumed in the region comes from introduced species; most research and technology development has targeted temperate climate species, and not enough effort has been make to take advantage of native species. An additional reason for giving priority to new policies and efforts related to genetic resources is the importance of such resources in light of the new biotechnologies.

A third area of priority deals with management technologies for farming systems, crops and resources. Most work to date has concentrated on specific crops and on the use of inputs. New

technologies must place greater emphasis on integration -between crops, pastures, forestry, animals- and on optimizing resource use rather than seeking to establish productivity ceilings for each crop, a typical approach of the Green Revolution. Some areas which will be increasingly important are soil management and conservation, use of organic fertilizers, minimal tilling systems, integrated pest management, farm-forest-pasture systems and recycling of waste products. At an aggregate level, studies of agroecological zoning and watershed and microwatershed management, among other topics, will also require greater attention.

The fourth important area is biotechnology. Advances in this field, particularly as regards the development of new, ecologically more benign relations between human beings and the environment, offer important opportunities. In addition to genetic improvement of species and the development of biocides, we have the opportunity to recover genetic resources and clean up water supplies and soils through biotechnological processes. Since biotechnology is a rapidly developing field, it is imperative that well-defined and aggressive strategies be devised that resolve all interested parties and countries in LAC in making use of this new technologies.

V. INSTITUTIONAL LIMITATIONS AND OPPORTUNITIES

Even though environmental and natural resources constrains have been on the rise, the institutional infrastructure to deal with these issues is at best weak. Environmental protection legislation is still in the making and the situation in most countries is one of fragmented responsibilities. In recent years, and probably in response to external pressures and the proximity of the next United Nations Conference on the Environment and Development, there is a continued trend toward institutional reform -in some cases including constitutional changes- and the creation of cabinet level structures to deal with the environment and natural resources protection; but in most cases, these are yet to become operational mechanisms as the process for transferal of responsibilities from the existing ministries or departments has been slow. In part this is due to the current structural adjustment and institutional reform process underway in the region which has severely restricted public expenditures in all areas, but also there is a lack of clear cut proposals as to how to handle environmental and natural resources issues and concerns in a new context where market mechanisms are becoming increasingly more important as the basis for the orientation of social decisions. This lack of clear cut responsibilities has made the development of appropriate information bases extremely difficult, particularly in sectors such as agriculture and different segments of industry where traditional indicators did not include or treated the environmental impact dimension only partially (Brañes 1991).

In terms of research the institutional situation shares many

of the same problems. Latin America and the Caribbean possesses a relatively sophisticated agricultural research and technology transfer infrastructure -specially in the public sector- based on the national agricultural research institutes introduced in the region starting in the late 1950s, and later complemented by the universities research activities at the national level, and those of other regional and subregional research organizations such as the CGIAR Centers and the Centro Agronómico Tropical de Investigación y Enseñanza, CATIE and the Caribbean Agricultural Research and Development Institute, CARDI. In more recent times there are also a number of successful experiences in the development of research networks and cooperative programs, involving both national and international organizations. This system has proved, until recent times, quite successful in providing support for the region's agricultural development efforts. Nevertheless it is no longer clear whether its present structure and research orientation continues to be functional and capable of meeting the challenges of the new research agenda.

Two different concerns must be addressed in regards to the national research infrastructures. One is of a general nature and regards to the level of support to agricultural research activities in the public sector. Concomitant with the debt crisis research and higher education in the region have suffered during the 1980s a substantial loss of funding support. With the exception of Colombia -which in the mid-1980s, benefitted from a major loan from the World Bank- budgetary allocations to research fell in almost

all the countries. By the mid-1980s research budgets were only 50 to 60 percent of the levels they reached at the beginning of the decade. Even in countries like Brazil, which continued to enjoy external loans support throughout this period, there has been a significant deterioration in terms of over-all resources for research (Trigo & Runsten). The impact of this trend was magnified by the fact that the reduction in available resources coincided with the maturity of some significant human resources and physical plant development initiatives, so the numbers of researchers continued to grow bringing about even sharper reductions in research capacity as measured in terms of resources per scientist. As a consequence of this situation in many cases there are clear evidences of the setting of a vicious circle between low productivity of research programs and lack of support. This is further aggravated by the prevailing, and often erroneous, view held by many donors and international financial institutions, that large components of the research agenda can be privatized, consequently reducing the need and priority for resource allocation to public research institutions. Data on the University situation is not readily available, but a similar general situation can be assumed to prevail.

A second concern refers to the type of research capabilities and methodologies needed for environmental and natural resources research and whether existing research institutions are able to confront the challenges in these new areas. The integration of environmental preservation and high production-productivity

priorities requires the institutional capability to integrate relevant expertise from the biological, physical, health and social sciences, something that has proven to be difficult even in the most advanced research institutions (Antle 1991). The difficulties and failures to institutionalize farming systems research in the past should be taken as examples that the type of problems that need to be confronted in creating the necessary professional and institutional incentives for multi-disciplinary research to become established and productive. Beyond these general issues there are some specific organizational aspects to be considered, particularly in relation to the severe limitations that the lack of local expertise and facilities impose on environmental and natural resources related research. Measurement and monitoring of environmental interactions in agricultural production activities requires advanced expertise and instrumentation that is not available in many developing world institutions. The measurement of exposure to toxic substances, and the capital investment required to access remote sensing techniques are good examples of the problems that are to be solved if relevant research to asses the impact of different technological strategies on major agro-ecosystems is to be undertaken on continued basis.

An additional related point is with respect to the type of scientific expertise needed to profit from what the new biotechnologies have to offer in therm of the development of a more environmentally benign technological path for agricultural activities. To access these new technologies research institutions

need a different type of scientific talents that the ones they have today. Disciplinary expertise in areas such as molecular biology, biochemistry, microbiology, virology, enzyme engineering, etc. is essential to exploit the new potentialities, and national ag. research institutions are not the places where this type of talents are found. Universities and other basic science research institutions are much better equipped in these fields, but coordination mechanisms are usually very weak or non-existent, so available capacities are not been fully utilized (Jaffé 1991).

In the context of the above limitations, the LAC region also has an extensive and quite well developed horizontal technical cooperation infrastructure which contributes in an important way to mitigate the above weaknesses (Trigo 1992).

Regional cooperative activities go back to the 1950s, but it was only in the early 1970s that networks and cooperative programs initiated their rapid development and consolidation as one of the distinguishing features of the regional agricultural research system.

Until now these initiatives have concentrated mostly on commodity improvement activities, however, in more recent times they have also started to include environmental preservation and natural resources management within their cooperative activities. The establishment of the Programa Cooperativo de Investigación y Transferencia de Tecnología para los Trópicos Sudamericanos, PROCITROPICOS, with the mandate to promote the development of sustainable technologies for the south american tropics, the

incorporation of research on to the environmental and natural resources impact of coffee production in the Central American countries within the activities of Programa Cooperativo Regional para la Protección y Modernización de la Caficultura, PROMECAFE, and the initiation by the Programa Cooprativo para el Desarrollo Tecnológico Agropecuario del Cono Sur, PROCISUR of a line of research to evaluate the potential environmental impact of economic integration in the context of the Mercado Común del Sur, MERCOSUR, among other initiatives, are important examples of this trend.

Networks and cooperative programs either through information exchange or improved coordination and development of joint research activities, is one of the most important elements in augmenting resources and increasing the effectiveness of national research and technology transfer institutions. This is particularly so in the case of the smaller countries where there are economic limitations for the development of full-sized research capabilities. Within Latin America and the Caribbean there exists considerable experience with this kind of mechanism which, over the last 15 years, has become a strategic complement to the functioning of most of the NARS in the region and should be seen as a strategic component of any international cooperation initiative in environmental and natural resources research. They offer both a logical organizational alternative for research on issues such as watershed and biodiversity management or transboundary pollution which are of an international nature, and an efficient way to

improve national capabilities in strategic areas and better exploit their areas of comparative advantages (Trigo, 1992).

CONCLUDING REMARKS

One-two pages touching on the following:

* The globality of environmental issues as the basis for a common research agenda. The urgency involved and the importance of information and new research as the basis for new environmentally benign production patterns that while preserving the resource base meet the production and productivity increases required of agriculture in the developing countries.

  Common problems and benefits and the need to also share the costs of developing sustainable alternatives to today's production patterns.

* Information and research needs and limitations. Types of information and research needed and institutional shortcomings and opportunities.

* The possible contributions of the international system. The CGIAR experiences. Methodological support, the Rockefeller projects (Antle 1991), Geographical Informations Systems support, CIAT.

* Funding support for (a) institutional development at the national level: stronger research capabilities represent a strategic investment for the whole international community, and international support can help orient national priorities and institutional reforms in the proper direction; (b) for networking and cooperative research: the countries are already investing some resources, but those are not nearly enough if we take the human resources development needs in this areas, "shared benefits-shared costs", not grants.

* Finally, an issue not discussed in the paper but that can hardly be left completely out. Access to strategic technologies. Many of the new technologies are already -and in the future the proportion will increase-subject to proprietary protection which limits its uses by developing countries; the GATT agreements on patents strengthen the impact of these issues. This is an important discussion in UNCED, and maybe we should include one paragraph calling attention to its importance in technology transfer and international cooperation on environmental natural resources research.

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