Impoverishment and Sustainable Development

A Systems Approach

GILBERTO GALLOPIN

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Contents

Preface

IISD's program on Poverty and Empowerment has set out to examine the linkages between sustainable development principles and impoverishment processes, from both "top-down" and "bottom-up" approaches. Unless we can successfully address the growing issue of poverty throughout the world, sustainable development will be compromised. Our examination seeks to identify how sustainable development concepts can add value to current approaches for poverty alleviation.

Dr. Gallopin's research, carried out while he was a Senior Fellow of IISD, presents a systemic approach which makes the connections among different social and ecological dimensions. The approach described here will be useful to researchers and practitioners seeking a broad understanding of the complex linkages among impoverishment and sustainable development processes. This systemic view is essential for understanding how poverty alleviation must build upon combinations of good local initiative and of changes at a macropolicy level, for example in the areas of trade and government budget reform.

Gilberto Gallopin has provided us with several important reference points. These include the need to:

- Broaden the scope of the issue from the state of poverty to the dynamic process of impoverishment.
- Broaden the boundaries of the reference system from the economic, social or cultural dimensions, to the whole socio-ecological or human/environmental system, at different levels of aggregation from the local to the global.
- Focus on the issues of access to options (either by transfer of experience, or by endogenous generation and widening of the repertoire of options).
- Assess the degree to which poverty eradication and sustainable development programs and strategies are replicable, and can be generalized to whole regions or even to the whole planet.

Future IISD studies on poverty and sustainable development issues will build on this systemic approach, and focus on specific issues to help decision-makers grapple with one of the most critical issues of our time.

Arthur J. Hanson
President & CEO

Acknowledgements

This book was written during my stay as a Senior Fellow at the International Institute for Sustainable Development.

The two most important basic sources for this book are two volumes on which I have collaborated with colleagues. The first is *Global Impoverishment, Sustainable Development and the Environment* by Gallopín, G.C., P. Gutman and H. Maletta, the output of a project supported by IDRC of Canada that I coordinated while I was living in Argentina. The second is *Sustainable Development: A Systems Approach* by Shaw, R., G.C. Gallopín, P. Weaver and S. Öberg, performed during my stay at the International Institute for Applied Systems Analysis. In both cases, I benefited very much from the professional and human interactions with my colleagues. The full references appear in the text. In addition, a summarized and popularized version of the first report prepared by Sandra Buckingham, was also very useful.

I wish to acknowledge the very useful comments and criticisms made by Dr. Cheywa Spindel and Dr. Atiq Rahman, who kindly agreed to review the document. This book also benefitted from valuable substantive suggestions and editorial help of Dr. Art Hanson, Gabriel Régallet, Aaron Cosbey, Julie Wagemakers, Rosemarie Philips, and Marnie Jull. Suggestions by Analía Penchaszadeh on applying the conceptual model proposed here to case-studies in the literature were also useful. Other important suggestions and criticisms were made by participants in a workshop in Rio de Janeiro, Brazil, where a first draft of the book was discussed.

The secretarial help of Thérèse Laberge is gratefully acknowledged.

Introduction

The World Commission on Environment and Development defined sustainable development as development that fulfills the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional changes are in harmony and enhance both current and future potential to meet human needs and aspirations.[1]

The World Commission on Environment and Development stated that the pursuit of sustainable development would require:

- a political system that secures effective participation in decision making,
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis,
- a social system that provides solutions for the tensions arising from disharmonious development,
- a production system that respects the obligation to preserve the ecological base for development,
- a technological system that can search continuously for new solutions,
- an international system that fosters sustainable patterns of trade and finance, and
- an administrative system that is flexible and has the capacity for self-correction.

Source: The World Commission on Environment and Development, *Our Common Future*, Oxford: Oxford University Press, 1987.

The Commission explicitly recognized 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 the industrial ones as well."[2]

This concept of sustainable development requires new approaches to the eradication of poverty. Until now, the most widespread approach to poverty alleviation has consisted of attempts to increase the productivity and income of poor groups in an attempt to duplicate the development patterns of the presently industrialized countries. However, for a number of reasons, this is at best a partial solution, and at worst, a self-defeating exercise. Firstly, the high per capita investment required makes most poverty alleviation programs inapplicable on a

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[1] United Nations Conference on Environment and Development (UNCED). "Agenda 21". Final Advanced Version adopted by the Plenary in Rio de Janeiro, July 9, 1992. Geneva: UNCED, 1992.

[2] World Bank President Lewis Preston's statement to the Earth Summit Plenary. Geneva: Centre for Our Common Future, July 1992.

global scale. Secondly, because poverty and impoverishment are often imbedded in the present functioning of national and global systems, it is not enough to bring poor people into existing growth patterns if substantial changes are not made in the way social and economic decisions are now made. Thirdly, because the lifestyle and development patterns of the industrialized countries are themselves environmentally unsustainable, no lasting solution to poverty can be found through this path.

This is not to imply that poor countries and poor people should abandon their aspirations for development while the rich countries and the rich sectors of the population continue their current practices. If global economic, social, and environmental trends seem questionable, the answer to poverty cannot simply be to bring poor people into the same boat, but to embark together on new boats in new directions. Global poverty eradication must be viewed in the context of a redirected global economy that shifts from present trends towards more sustainable and environmentally sound strategies.

Given the rapidly increasing ecological and economic interdependence, there can be no separate solutions for the South and for the North. Either a global solution is found, or there will be no solution at all. Eradicating poverty requires rethinking the development patterns of both developing and industrialized countries.

While environmental destruction is happening almost everywhere, the extreme forms of poverty are concentrated among the rural people of developing countries. Here the environment is being degraded not only to support economic growth, as in industrialized countries, but also to support the mere survival of ever increasing numbers of poor. No lasting progress against human or environmental impoverishment is possible until the plight of the environment is treated as one with the plight of the people.

This volume argues that poverty eradication can be viewed in a number of ways:

- As an end in itself. Poverty is a serious but solvable problem, rather than an inescapable fact of life.
- As a way of removing a major obstacle to sustainable development. The huge inequalities (between and within countries) characterizing the current world situation are a source of tension and social conflict. Poverty itself is one major driver of environmental degradation. If development is to be sustainable, dramatic increases in equity are required.
- As a means of moving towards sustainable development. Many poor communities have developed participatory and decentralized forms of governance and resource management that contain valuable lessons that could be applicable for society as a whole. This empirical and pluralistic experience in developing creative solutions to poverty eradication—along with the associated capital of shared motivation—could constitute a rich source of renewal for societal change and development. Examples of this type of experience include the Self Employed Women's Association (SEWA), the Chipko Movement, the Sarvodaya Shramadana Movement, the World Rainforest Movement, the Asamblea de Barrios, the Six S

Association, the Working Women's Forum, the Grameen Bank, the South Shore Bank, the various informal economy groups and cooperatives, and many others that are less well known.

This volume does not attempt to make a diagnosis of poverty; nor does it offer a comprehensive overview either of where and how poverty is experienced or of various approaches to its mitigation or eradication. Rather, it develops a systemic framework as a basis for pursuing more integrated ways to eradicate poverty. More specifically, it develops a conceptual approach that can be used to help *eradicate poverty by moving into sustainable development*. The emphasis is not on creating new concepts, but rather on interpreting and combining central concepts and ideas belonging to different areas of knowledge in an effort to develop a systemic perspective that complements, rather than replaces, existing approaches to poverty eradication.

Adopting such a systemic perspective has some important consequences:

- It broadens the scope of the poverty issue from a state (poverty) to a dynamic and active process (impoverishment).
- It broadens the boundaries of what is meaningful from economic, social, or cultural dimensions to consideration of the whole socio-ecological or human/environmental system at the local as well as the global level.
- It highlights a set of fundamental systemic properties relevant to impoverishment and sustainability that go beyond the notions of deprivation and lack of resources.
- It emphasizes the importance of taking into account not only intersectoral and intersystemic (i.e., "horizontal") linkages, but also "vertical" ones (across local, national, and global levels).

The book begins by making explicit a set of basic premises. The following section introduces the basic concepts of poverty and impoverishment. In the section, "Impoverishment and Sustainability," the concept of socio-ecological systems is introduced and the issues of "access to options" (rather than to specific techniques or resources) and of the replicability of poverty-eradication efforts are discussed. In the following section a case is made for the need to use systems perspectives in the treatment of impoverishment and sustainable development; not as a rigid construct, but as a flexible and dynamic way of looking at the world. Immediately after, a set of five concepts denoting systems properties considered critical for impoverishment and sustainable development is proposed and discussed.

The question of causal interlinkages is later addressed, including both the "horizontal" linkages that take place between biophysical and human phenomena belonging to the same level of aggregation (whether local, national, or global), and the "vertical" linkages across levels. The book then highlights some major policy implications derived from the systems approach adopted, and concludes with the identification and characterization of five central areas of research that can help lead to better understanding of how impoverishment processes can be reversed or avoided and transformed into sustainable development paths.

Basic Premises

The analysis in this volume is based on the following premises. While they can all be demonstrated or at least supported with strong evidence, they are posited as givens:

- Prevailing development patterns in both the South and the North are seriously flawed and are failing dramatically for two reasons: 1) not only has poverty not been eradicated, it is actually rising, and 2) ecological life-support and natural-resource systems are being seriously damaged from the local to the global level. The current trajectory is thus clearly unsustainable.
- Two major sources of environmental degradation can be distinguished: prevailing patterns of economic growth in affluent societies (and the affluent sectors within poor countries) and poverty. These situations – *unsustainable development* and *intolerable impoverishment* – are different but not unconnected. At a higher level of analysis, affluence and poverty are complementary sides of the current global economy, which is characterized by increasing inequality and a growing asymmetry between rich and poor countries, and between the rich and poor sectors within many countries.
- Substantial change from the current trajectory is not an option, but an absolute necessity. Current problems cannot be solved by incremental corrective measures; more (even if better) of the same is not enough. Radical, fundamental economic, social and cultural changes that address the root causes of poverty and environmental degradation are required. And they are required now. In some instances, time has already run out.
- The shift to a sustainable development path is hindered in two ways. First, vested interests, the current power structure, and the lack of political will prevent societies from facing the problem and implementing the obviously necessary socio-economic and political changes. Second, the limitations of the widespread sectoral approach to problem-solving, which ignores linkages among sectors or across local, national, and global levels, are exacerbated by the growing complexity and interdependence of problems as well as the unprecedented speed and scale of societal and environmental changes. The first kind of obstacle requires changes in values and in the distribution of power; the second, requires new ways of thinking and acting.
- A new pattern (or patterns) of development must be ecologically, economically, and socially sustainable. A necessary (but not sufficient) condition for social sustainability is a dramatic increase in equity. Sustainable development implies inter-generational equity, but also intra-generational equity (between and within societies). It is in the long-term interest of everyone to reduce inequity. Sustainability is a necessary, but not sufficient, condition for development. Sustainable poverty is not acceptable.
- Even allowing for rapid technological change, resources are finite. A basic sustainable level of per capita material consumption will have to be

reached. This will require both increasing the material consumption of the billions of people now living in poverty and reducing material *over*consumption by the rich minority (by reducing individual consumption levels or by increasing the overall resource and energy efficiency of the economy, or both).

The income gap between the richest and the poorest at the global level has been widening in the past 30 years. Between 1960 and 1989, the countries with the richest 20 percent of world population increased their share of global GNP from 70.2 percent to 82.7 percent. The countries with the poorest 20 percent of world population saw their share fall from 2.3 percent to 1.4 percent. The consequences for income inequalities have been dramatic. In 1960, the top 20 percent received 30 times more than the bottom 20 percent, but by 1989 they were receiving 60 times more.

Even these figures conceal the true scale of injustice since they are based on comparisons of the average per capita incomes of rich and poor *countries*. In reality, of course, there are wide disparities within each country between rich and poor *people*.

Global inequality would be expressed much more accurately if such national income disparities were taken into account. Relatively few countries publish information on income distributions, but a calculation for a group of 41 countries for which data are available produces a country-based inequality ratio of 65 to 1 – though once internal income distribution is taken into account, the ratio between the richest and the poorest people more than doubles to 140 to 1. The inequality ratio for the whole world may be well over 150 to 1.

Source: United Nation Development Programme. *Human Development Report 1992*. New York: Oxford University Press, 1992.

- One way or another, global population will have to stabilize eventually. Global population stabilization can be reached through cooperation and improvement in living conditions and quality of life or through coercion and violence. The former can be achieved through, as well as contribute to, socially sustainable development; the latter not only is ineffective, it is hardly conducive to sustainable development.
- Development is not synonymous with economic growth. Development involves qualitative transformations; growth is essentially quantitative increase. The goal of development is to increase the quality of life of the human population; economic growth is only one means to this end. Quality of life embodies the satisfaction of material and non-material human needs (resulting in the level of health reached) and the fulfillment of human desires and aspirations (resulting in the level of subjective satisfaction obtained). Human needs, desires, and aspirations can be met through a variety of alternative material and non-material means.

- Humans are social entities. Development implies essentially the amelioration of different human communities at different levels of aggregation that represent the basic social organization of mankind, and within which individuals may wither or prosper. Exclusive emphasis on individual achievements may lead to impoverishment of the community, destruction of the social fabric, and increased inequity and unsustainability.
- Economic growth is not necessarily synonymous with material growth. The prevailing form of material economic growth is now confronting two kinds of environmental limitations: *source limitations* (e.g., scarcity and destruction of natural resources) and *sink limitations* (e.g. saturation of the natural capacity for dilution and processing of pollutants and wastes). Recent trends indicate that material production is relatively less important in the economy than it was; examples include the increasing share of services in the GNP and the lower per unit utilization of energy and material resources by new and emerging knowledge-intensive technologies. Nevertheless, such intangible GNP will not feed the poor, and therefore the question of redistribution of wealth and intra-generational equity is inescapable.
- Sustainable development need not imply the cessation of economic growth – a zero-growth material economy with a growing non-material economy is the logical implication of sustainable development. While demographic growth and material economic growth must eventually stabilize, cultural, psychological, and spiritual growth is not constrained by physical limits.

Poverty versus Impoverishment

Recent International Poverty Eradication Initiatives

Poverty eradication received little or no attention from the world's official development agencies during the 1980s; the concept, which had received widespread attention during the 1960s and 70s, reappeared first in the report of the World Commission on Environment and Development issued in 1987 and even more strongly during the preparatory phase of the United Nations Conference on Environment and Development (UNCED) in 1991–92. While many governmental and nongovernmental organizations are active and knowledgeable in this area, it is worth focusing on the role of two major international development actors, the World Bank and the United Nations Development Programme (UNDP), before analyzing the Agenda 21 proposal dealing with poverty eradication. Agenda 21 is the official strategic document for sustainable development approved at UNCED in June 1992.[1]

The World Bank and UNDP have been designated as leading agencies in the international effort to combat poverty. The Bank is in charge of financial commitments "to help poor countries meet their sustainable development objectives as contained in Agenda 21,"[2] and of preparing poverty assessments for all borrowing countries by the year 1994; these will serve as the basis for national and Bank efforts at poverty reduction. UNDP is the lead agency in organizing United Nations system efforts at capacity-building.

Three recent *World Development Reports* (WDR) constitute a trilogy of the World Bank's goals and approaches to economic development.[3] The 1990 WDR, entitled *Poverty*, includes a strategy explicitly intended to reduce poverty through policies that promote the productive use of labor resources, provide widespread basic social services, and create a program of well-targeted transfers and safety nets for special needs. The 1991 WDR, entitled *The Challenge of Development*, expands upon the Bank's overall strategy for economic development by concentrating on the welfare gains attributable to a system of free-market economics. The "market-friendly" strategy for development promotes policies directed at four specific areas: more investments in human capital; an enabling, competitive environment for enterprise; full integration within the global economy; and the maintenance of macroeconomic stability. The linkages involved in this strategy are dealt with explicitly by the World Bank, with special importance given to capital flows and technological change, education, and physical infrastructure. The 1992 WDR, entitled *Development and the Environment*, attempts to extend the earlier concepts of development to a fuller consideration of the environment and a policy framework aimed at sustainable development. A two-stage strategy is proposed. The first stage concentrates upon improvements to the environment through

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[1] United Nations Conference on Environment and Development (UNCED), "Agenda 21", Final Advanced Version adopted by the Plenary in Rio de Janeiro, July 9, 1992. Geneva: UNCED, 1992.

[2] World Bank President Lewis Preston's statement to the Earth Summit Plenary. Geneva: Centre for Our Common Future, July 1992.

[3] Lumsden, G. *Poverty Reduction and Sustainable Development: A Critique of Central Arguments of the Human Development Reports and World Development Reports*. Technical Report, Winnipeg, Canada: International Institute for Sustainable Development, August 1992.

reorganization and reallocation of resources according to a criterion of improved economic efficiency. The second suggests changes according to specific environmental assessments. The market-friendly policies emphasized in the 1991 report are presumed to be sufficient to result in an improved environment, although two possible exceptions are acknowledged: the need to remove distortions that encourage too much resource use, and the clarification of property rights as a procedure to limit environmental degradation.

Building on the findings in *World Development Report 1990*, policies were adopted in fiscal 1991 for fully integrating into Bank operations the two-part approach for reducing poverty. The urgency of the task is compelling: According to *World Development Report 1992*, the number of poor increased at almost the rate of population growth during the second half of the 1980s. *World Development Report 1990* had identified a path of poverty reduction that could reduce the number of poor in the world by 300 million between 1985 and 2000. The 1992 report concludes, however, that such a target no longer appears feasible, partly as a result of the severity of the current recession and the disappointing progress in the 1985–90 period. In fact, the number of absolute poor in the world at the turn of the century will probably be higher than in 1985.

Source: The World Bank. *The World Bank Annual Report 1992*. Washington, D.C.: The World Bank, 1992, p. 46.

The *Human Development Reports* (HDR) issued by the UNDP during the same period attempt to reassert the importance of *people* in the development process. Human development is seen as a process of widening people's choices and increasing their level of well-being. As a concept, it is intended to embrace all earlier approaches to development and all countries at all stages of their evolution. In an attempt to make relevant experience available to policymakers, and contribute to the definition and measurement of human development, the 1990 HDR creates the human development index, intended to reflect a composite of values related to longevity, knowledge, and living standards across countries. The 1991 HDR recommends optimizing human development expenditures through restructuring national budgets, reallocating social expenditures, and promoting decentralized participatory decision making on important development issues. A variety of indicators are constructed as guides to policy analysis in this area. The report demonstrates that the potential for releasing financial resources and redirecting them towards the development process is great. According to UNDP, it is lack of political commitment that is, more often than not, the real cause of increasing impoverishment. The 1992 HDR concentrates on the international dimensions of the development problem. Disparities between rich and poor nations are viewed as widening as a result of immigration policies, barriers to trade, and deepening international indebtedness. While improvements in the international environment can rarely be considered a substitute for domestic

reforms, the report suggests a number of changes in existing institutions like the United Nations, the World Bank, the Global Environment Facility, and the General Agreement on Tariffs and Trade (GATT) that could strengthen the presence of developing countries in global markets.

While the degree of emphasis may vary between the policies of the UNDP and the World Bank, the approaches to poverty reduction advanced by the two institutions are broadly similar and are contained in the following points:

- Emphasis upon the importance of economic growth stimulated through increased capital flows to developing economies, including private foreign investment, external assistance, debt re-scheduling, and liberated trade flows.
- A restructuring of the public sector towards efficient and cost-effective provision of basic social services, including investment in human capital and policies that promote labor-intensive production in specific sectors.
- A restricted role for government in the actual productive process, in favor of promoting private initiative and enterprise in a free-market framework.
- An increased interest in the human development repercussions of structural adjustment processes imposed upon developing countries by external factors and institutions.
- An increased recognition of the relationship between environmental degradation and economic development.

Do the World Bank and UNDP approaches tackle the interlinked issue of sustainable development and poverty eradication? To what extent would the proposed policies result in a significant reduction in poverty? The context surrounding the situation of poverty and, more importantly, the process of active impoverishment are not clearly integrated in either analysis. Neither are the systemic properties of the problem and the interlinkages among social, economic and ecological factors. These missing considerations undermine successful achievement of poverty-related objectives.

Moreover, both the World Bank and the UNDP discussions concentrate upon concepts of economic growth and development, without fuller consideration of the broader concept of sustainable development. While they acknowledge the implications of sustainable development, the concept is not fundamental to the analysis. In particular, the concepts of time and intergenerational impact are not properly addressed.

The adoption by UNCED of Agenda 21 has provided a strong statement of consensus regarding the long-term objective of enabling all people to achieve sustainable livelihoods. Recommended activities include cross-cutting measures for empowering communities and groups and management-related activities in the fields of health, employment, resource use, land management, participation, food security, access to land, credit, assets, education. However, even though there is an appeal for promoting international cooperation to address the root causes of poverty, the Agenda 21 chapter on poverty eradication does not go very far either

toward linking poverty eradication with achieving sustainable development or toward bringing forward innovative solutions to external indebtedness, inadequate development finance, trade barriers, depressed commodity prices, and poor terms of trade in developing countries.

Three recent initiatives by nongovernmental organizations (NGOs) are worth mentioning. During the official meetings of UNCED, NGOs met in a parallel meeting called the Global Forum, which adopted an Earth Charter and 32 alternative treaties forming the basis for joint NGO action; one of these was a Treaty on Poverty and Affluence. Agenda 21 recognizes the importance of the NGO sector and the fact that its experience at the local level gives it a legitimate say in the design of policies. The treaties offer strong criticism of the existing models and practices of development, arguing that these lead to impoverishment and disempowerment of people in both the North and the South, and that a new sense of community among all peoples and of interdependence among all living things is needed. Messages to emerge from the treaty process are:

- existing structures of governance disempower the majority of peoples;
- no problem can be solved in isolation; an inter-sectoral approach, which looks at problems within the economy and the political structure, is needed;
- local people need to be given control of their resources; the best sustainable managers are those who depend on the resources for their daily livelihood;
- women must not be neglected in decision-making processes; they are the primary producers and managers of the resources essential to their families' survival;
- existing NGO networks need to be strengthened and new ones created to ensure rapid dissemination of information and resource sharing.

Another recent initiative comes from a coalition of Southern NGOs called the Global Forum on Environment and Poverty, whose secretariat is at the Bangladesh Centre for Advanced Studies. Meeting in Rio de Janeiro, this forum adopted a Declaration on Poverty and Environment, along with an action agenda calling for sustainable and equitable development patterns, stabilization of consumption and population, empowerment of women, demilitarization and participatory, decentralized, and democratic institutions of collective decision-making.

Primary Environmental Care (PEC) – promoted by the International Union for the Conservation of Nature (IUCN), the World Wildlife Fund (WWF), and the United Nations Environment Programme (UNEP) – provides another practical approach to dealing with poverty and the environment at the local level. PEC offers a means by which local communities can organize themselves to protect the environment while their needs are being met. It encompasses three essential components: meeting basic needs, caring for the environment, and community empowerment. It includes issues like health care and income generation.

These are just a few recent international initiatives in the areas of poverty eradication and sustainable development. Few of the research and field-based activities in these areas actually address poverty and impoverishment in a framework of sustainable development, or link micro and macro levels of decision making.

Poverty is Not Just Economic

The concept of poverty, in simple terms, is usually taken to mean a state of economic deprivation. According to this definition, some 1.2 billion people (or 23 percent of the global population) live in absolute poverty; this represents 25 percent of the total population in Asia, 62 percent in sub-Saharan Africa, 28 percent in North Africa and the Middle East, and 35 percent in Latin America. Despite rapid urbanization and the increase in urban poverty in much of the world, four-fifths of those in absolute poverty still live in rural areas (only in Latin America do a large proportion of the poor live in cities).[4] The rural poor tend to be pushed either to the cities or to poorer and marginal land. The proportion of the rural poor living on marginal or fragile land is estimated at 47 percent.[5]

But poverty is far more than an economic condition. It extends to all aspects of individual life and includes physical weakness and sickness, lack of access to most essential services, lack of information, limited control over resources, subordination to and exploitation by higher social and economic power, extreme vulnerability to sudden stress, insecurity in the face of changing circumstances, erosion of human dignity and self-respect, and social and cultural marginalization. Powerlessness, in industrialized and developing countries alike, is one of the most dominant characteristics of destitution.[6]

In terms of human needs, any fundamental need that is not adequately satisfied reveals a poverty. Thus one should not speak of poverty, but of poverties,[7] each of them capable of generating pathologies.[8]

Table 1 offers one classification of human needs and shows how they are satisfied. Traditional definitions of poverty refer mostly to poverty of subsistence (due to insufficient income, food, shelter, etc.), but poverties may arise from the lack of satisfaction or the inadequate satisfaction of any of the fundamental human needs shown in the table. An example is the poverty of identity (due to imposition of alien values upon local or regional cultures, forced migration, etc.) suffered by many indigenous populations and local communities around the world. Asserting this

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[4] Durning, A. "Life on the Brink." *World-Watch* (March-April 1990).

[5] Preparatory Committee for the United Nations Conference on Environment and Development. "Poverty and Environmental Degradation." A/CONF.151/PC/45. Geneva, July 5, 1991.

[6] Preparatory Committee for the United Nations Conference on Environment and Development. "Poverty and Environmental Degradation." A/CONF.151/PC/45. Geneva, July 5, 1991.

[7] Mallmann, C. A., O. Nudler and M. A. Max-Neef. "Quality of Life Oriented Development and Global Social Modelling." S. C. Bariloche, Argentina: Synergic Development Group, 1979 (Mimeo).

[8] Max-Neef, M. et al. "Human Scale Development: An Option for the Future." *Development Dialogue* 1989:1, pp. 5–80.

Table 1

A systematization of human needs and their satisfiers.

Source: Max-Neef, M. et al. 1989. "Human Scale Development: An Option for the Future"; Development Dialogue 1989: 1: pp. 5–80.

Table 1 Matrix of needs and satisfiers*

Needs according to existential categories / Needs according to axiological categories	Being	Having	Doing	Interacting
Subsistence	1/ Physical health, mental health, equilibrium, sense of humour, adaptability	2/ Food, shelter, work	3/ Feed, procreate, rest, work	4/ Living environment, social setting
Protection	5/ Care, adaptability, autonomy, equilibrium, solidarity	6/ Insurance systems, savings, social security, health systems, rights, family, work	7/ Cooperate, prevent, plan, take care of, cure, help	8/ Living space, social environment, dwelling
Affection	9/ Self-esteem, solidarity, respect, tolerance, generosity, receptiveness, passion, determination, sensuality, sense of humour	10/ Friendships, family, partnerships, relationships with nature	11/ Make love, caress, express emotions, share, take care of, cultivate, appreciate	12/ Privacy, intimacy, home, spaces of togetherness
Understanding	13/ Critical conscience, receptiveness, curiosity, astonishment, discipline, intuition, rationality	14/ Literature, teachers, method, educational policies, communication policies	15/ Investigate, study, experiment, educate, analyse, meditate	16/ Settings of formative interaction, schools, universities, academies, groups, communities, family
Participation	17/ Adaptability, receptiveness, solidarity, willingness, determination, dedication, respect, passion, sense of humour	18/ Rights, responsibilities, duties, privileges, work	19/ Become affiliated, cooperate, propose, share, dissent, obey, interact, agree on, express opinions	20/ Settings of participative interaction, parties, associations, churches, communities, neighbourhoods, family
Idleness	21/ Curiosity, receptiveness, imagination, recklessness, sense of humour, tranquility, sensuality	22/ Games, spectacles, clubs, parties, peace of mind	23/ Day-dream, brood, dream, recall old times, give way to fantasies, remember, relax, have fun, play	24/ Privacy, intimacy, spaces of closeness, free time, surroundings, landscapes
Creation	25/ Passion, determination, intuition, imagination, boldness, rationality, autonomy, inventiveness, curiosity	26/ Abilities, skills, method, work	27/ Work, invent, build, design, compose, interpret	28/ Productive and feedback settings, workshops, cultural groups, audiences, spaces for expression, temporal freedom
Identity	29/ Sense of belonging, consistency, differentiation, self-esteem, assertiveness	30/ Symbols, language, religion, habits, customs, reference groups, sexuality, values, norms, historical memory, work	31/ Commit oneself, integrate oneself, confront, decide on, get to know oneself, recognize oneself, actualize oneself, grow	32/ Social rhythms, everyday settings, settings which one belongs to, maturation stages
Freedom	33/ Autonomy, self-esteem, determination, passion, assertiveness, open-mindedness, boldness, rebelliousness, tolerance	34/ Equal rights	35/ Dissent, choose, be different from, run risks, develop awareness, commit oneself, disobey	36/ Temporal/spatial plasticity

* The column of BEING registers *attributes*, personal or collective, that are expressed as nouns. The column of HAVING registers *institutions, norms, mechanisms, tools* (not in a material sense), *laws*, etc. that can be expressed in one or more words. The column of DOING registers *actions*, personal or collective, that can be expressed as verbs. The column of INTERACTING registers *locations and milieus* (as times and spaces). It stands for the Spanish ESTAR or the German BEFINDEN, in the sense of time and space. Since there is no corresponding word in English, INTERACTING was chosen 'à faut de mieux'.

does not in any sense minimize the incidence and gravity of the poverty of subsistence, nor should it equate the problems of the starving child and the alienated rich person. It does, however, emphasize the complexity of the concept and the importance of simultaneously addressing the satisfaction of the entire system of human needs.

Eradication of poverty cannot be accomplished by simply distributing food to the poor. The conditions that promote self-reliance, understanding, identity, etc., must be addressed as well. Particularly important from a strategic viewpoint is the need for participation, since it influences people's ability to create the conditions that will help satisfy other needs.

A comparison of the major theories of poverty indicates:

- There is a clear split between theories that focus on poor groups and theories that focus on social relations as a source of poverty.
- Most theories are descriptive rather than explanatory.
- Very little is said about the relationship between the environment and society in most social poverty theories, and nature generally is presented as a stock of resources with no reference to natural dynamics.
- An integration of different theories seems necessary in order to examine poverty problems at a global scale. While social interactions and the relations between local, regional, and international levels cannot be left out, an understanding of the role of local systems (values, culture, resources, environment) and of day-to-day concerns related to poverty must also be considered.[9]

Historical and current interactions among society, population, technology, and nature are of critical importance in determining the dynamics and consequences of poverty. But integrated and comparative studies taking these interactions into account are scarce. In particular, the crucial environmental connection is often missed by poverty analyses. Similarly, environmental studies often fail to focus attention on the relationship between poverty and environment.

Poverty is, in part at least, both an effect and a cause of environmental degradation. "Poor people are forced to overuse environmental resources to survive from day to day, and their impoverishment of the environment further impoverishes them, making their survival ever more difficult and uncertain."[10]

The victims of natural disasters are mostly the poor, and they become poorer as a consequence. A number of natural disasters such as floods or droughts may actually be caused by past human intervention (through deforestation for example). Other disasters start as natural events but have a disastrous effect because of a particular local social arrangement.[11] Examples include hurricanes or

[9] Gallopín, G. C., P. Gutman and H. Maletta. "Global Impoverishment, Sustainable Development and the Environment." A Report to IDRC; S. C. Bariloche, Argentina: GASE, March 3, 1989.

[10] The World Commission on Environment and Development. *Our Common Future*. Oxford: Oxford University Press, 1987.

tsunamis that hit coastal regions of dubious habitability that nevertheless are populated by people with nowhere else to go. A disaster's effects can also be multiplied by other social factors of impoverishment: poor roads may hinder the escape of affected people or the arrival of help; poverty leads the victims to build inadequate homes that are easily destroyed when the disaster comes; an inefficient organization of public services for poorer areas may compound the impact of a natural disaster; corruption in high places could divert aid funds for private purposes; etc.

Similar events may have different consequences in poor and rich countries, or have differential impacts upon groups in the same society. A few cold days may have little effect on well-fed and well-lodged social groups but may kill a malnourished child or a homeless adult. What could be a minor irritation for groups with a decent standard of living may prove disastrous for the poor.

Impoverishment: A Dynamic Process to be Reversed

Poverty is usually seen as an initial state, to be overcome through progress or deliberate policy; it is not usually considered a possible *result* of progress or policy. Impoverishment is an active process, not just an initial, or a backward, state;[12] it is continually reproduced and generated through a number of currently active mechanisms.[13] This is only rarely recognized. Even the new indicators of human development principally refer to the symptoms of poverty, not to the factors generating it. According to one report:

> *"Poverty is not a state of being, it is the effect of dynamic processes. While it is important to know where poverty is greatest, it is critical to know why it exits. This inquiry necessarily leads away from the nature of the poor as individuals to the nature of their social and physical environment. Poverty is not only a personal phenomenon, it is a social status. As such, while its effects can be measured on the level of the individual, its causes must be sought elsewhere. From the point of view of poverty alleviation the process of becoming is just as important as the state of being."*[14]

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[11] Hagman, Gunnar et al. *Prevention Better Than Cure: A Report on Disasters Affecting Man and the Environment in the Third World.* Stockholm and Geneva: Red Cross, 1984. (Spanish translation, *Mejor prevenir que curar*, Stockholm and Geneva, 1985).

[12] Rahnema, M. "Global Poverty: A Pauperizing Myth." *Interculture* 24(2), pp. 4–51.

[13] A vivid summary of one operating mechanism is given by Agarwal: "In this manner the cycle of destruction is complete. The forest departments have destroyed forests by selling off timber to the industrial and urban interests. The firewood shortage and the resulting soil erosion is keeping the productivity of Indian agriculture low. Crop lands have expanded on to marginal lands and have reduced grazing lands. Animals have moved into forests and are preventing regeneration. All the chickens are coming to roost. Meanwhile as landlessness and joblessness grow, even groups like the tribals who from times immemorial have lived in total harmony with forests are turning against forests and want to sell them off as fast as they can" (Agarwal, A. 1984, "Beyond Pretty Trees and Tigers: The Role of Ecological Destruction in the Emerging Patterns of Poverty and People's Protests", ICSSR Newsletter 15 (1): pp. 1–27).

[14] Jazairy, I. *The State of World Rural Poverty. An Introductory Summary."* Rome: International Fund for Agricultural Development (IFAD), 1992, p. 18.

The number of poor has clearly been growing. In the early 1980s, estimates of the number of people living in absolute poverty ranged between 700 million and 1 billion. World Bank figures indicate that the global poverty ratio in 1980 was 22.3 percent, after declining gradually and steadily since mid-century. Since 1980, poverty has increased dramatically in sub-Saharan Africa, Latin America and parts of Asia, swamping reductions in China and India. Today, at least 200 million more people live in absolute poverty than in 1980. Thus, during the 1980s, the global poverty ratio not only stopped falling, it actually rose to 23.4 percent of the total population.[15]

Impoverishment is not confined to the poorest countries. From 1950 to 1980, the gap between rich and poor nations has grown, mostly because the rich got richer. Since 1980, the poor within many developing countries have been getting poorer, too.[16] Income disparities between the top 20 percent and the bottom 20 percent of the world's people have doubled over the last three decades.[17]

The income gap between the richest and the poorest at the global level has been widening in the past 30 years. Between 1960 and 1989, the countries with the richest 20 percent of world population increased their share of global GNP from 70.2 percent to 82.7 percent. The countries with the poorest 20 percent of world population saw their share fall from 2.3 percent to 1.4 percent. The consequences for income inequalities have been dramatic. In 1960, the top 20 percent received 30 times more than the bottom 20 percent, but by 1989 they were receiving 60 times more.

Even these figures conceal the true scale of injustice since they are based on comparisons of the average per capita incomes of rich and poor *countries*. In reality, of course, there are wide disparities within each country between rich and poor *people*.

Global inequality would be expressed much more accurately if such national income disparities were taken into account. Relatively few countries publish information on income distributions, but a calculation for a group of 41 countries for which data are available produces a country-based inequality ratio of 65 to 1 – though once internal income distribution is taken into account, the ratio between the richest and the poorest people more than doubles to 140 to 1. The inequality ratio for the whole world may be well over 150 to 1.

Source: United Nation Development Programme. *Human Development Report 1992*. New York: Oxford University Press, 1992.

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[15] Durning, A. "Life on the Brink." In *World-Watch* (March-April 1990).

[16] Durning, A. "Life on the Brink." In *World-Watch* (March-April 1990).

[17] Pronk, J. and M. Haaq (Co-Chairmen). "The Hague Report. Sustainable Development: From Concept to Action." Conclusions of The Hague Symposium (November 25–27 1991). Dutch Ministry of Development Cooperation, United Nations Development Programme, and United Nations Conference on Environment and Development, 1992.

This phenomenon cannot be simply attributed to population growth. In a few developing countries, even with high population growth rates, poverty declined, and in a number of developing countries with relatively low population growth, it increased. Poverty also rose during the 1980s in a number of developed countries, particularly in the United States, the United Kingdom, and Eastern European countries.[18]

In many industrial and developing countries, a growing disparity in the distribution of income indicates impoverishing people. For instance, in the United States, official reports indicate a long-term pattern of increasing disparity between rich and poor not merely from year to year, but from decade to decade. In 1989, before the recession began, the poverty rate was higher than 10 years earlier. The poorest fifth of the population was living on incomes actually lower than in 1979, even counting tax cuts and social welfare benefits. But the incomes of the top fifth were significantly higher than a decade earlier.[19] Impoverishment cannot be simplistically attributed to the short-term economic recession.

The mechanisms and dynamics of impoverishment need to be understood in order to devise useful strategies. Not only we do not know enough about the causes and mechanisms of modern impoverishment, but we know even less about how to eradicate poverty through sustainable development.

"The trouble is, we think that we know about poverty, and that all that remains is to think up better ways to do...what? *Eradicate it? Reduce it? Alleviate it? Cope with it? Manage it?* Quite aside from being unsure what it is that we want to do about poverty, we are wrong to think that combatting poverty simply boils down to *knowing how* without, at the same time, being clear about the *what* of poverty. We need to know what causes poverty, whether poverty is one big or many small questions. There are urban and rural poor, and for a few, poverty may be a chosen way of life. Others, though they might live poorly by some standards, don't think of themselves as poor. Still others are poor temporarily, while many who are born into poverty do not expect ever to escape their condition and have come to accept it as in some sense a natural condition. Nor is poverty viewed everywhere, as it is in Western countries, as a radical evil that prevents the poor from 'human flourishing.'

These are some of the issues that need to be separated and clarified. What we are looking for is an understanding of poverty as a public issue that must be approached collectively."

Source: Friedmann, J. *Empowerment. The politics of Alternative Development.* Cambridge: Blackwell, 1992, p. 55.

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[18] Durning, A. "Life on the Brink." *World-Watch* (March-April 1990).

[19] *International Herald Tribune*, October 1, 1991, p. 6.

Impoverishment Mechanisms and Processes

Although there may be a large number of "mega-processes" responsible for social and ecological degradation, it is possible to identify in particular cases the turning point at which the rate and direction of change surpasses the capacity of a particular community to respond, putting in motion an impoverishment process in the social and natural subsystems. Some examples are:

- The expansion of a consumerist culture dislocating the social fabric, and the globalization of the international market economy mainly based on private rather than social benefit, competitiveness rather than cooperation.
- The dismantling and dysfunction of many state functions, particularly its regulatory roles in the areas of wealth redistribution and protection of natural resources and the environment.
- Changes in the world market that foster major shifts in production and technology in rural areas in the South (from staples for local markets to export crops, from food to feed crops, etc.). This generally leads to quick social differentiation where an important percentage of the rural population lacks the resources needed to participate in the new economic configuration and is therefore pushed to marginal areas and activities.
- The widespread and indiscriminate application of structural adjustment policies recommended by international banks and the International Monetary Fund, emphasizing harsh anti-inflationary measures irrespective of their social and environmental consequences. This has resulted in an increase in poverty (in absolute and relative terms) in many developing countries.
- The endogenous processes favoring the spread of ineptitude, corruption, greed, and lack of accountability among national and sub-national governments in many countries.
- The increasing loss of local control over resources and key aspects of livelihood (due, among other factors, to increasing interdependence, complexity, globalization, and polarization of power).[20]
- Destabilization of traditional agricultural systems due to population growth or immigration, restricted access to new resources, and the resulting loss of resources because of over-exploitation and erosion.[21]

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[20] For instance, the unchecked growth of transnational corporations allows a pattern and degree of wealth accumulation on a worldwide scale that undoubtedly deepens the divide between the rich and the poor. Although they may have some positive effects as vehicles for the spread of technical advances, transnational corporations do not have built-in mechanisms to respond to the social interests and needs that are touched by the companies' activities. Their private interests, given their gigantic sizes and their increasing capacity to move from one to another geographical setting, can easily disrupt natural and social systems at unprecedented scales. (Gallopín, G. C., P. Gutman and H. Maletta. "Global Impoverishment, Sustainable Development and the Environment." A Report to IDRC. S. C. Bariloche, Argentina: GASF, March 3, 1989).

[21] See Heckadon Moreno, S. "La colonización campesina de bosques tropicales en Panamá"; Estudios Rurales Latinoamericanos 4(6) (1981), pp. 288–306; and the issue of *Mountain Research and Development* 2(1) (1982).

- Encroachment of peasant communities by expanding commercial agriculture (particularly in areas with large pre-existing indigenous populations).[22]
- Inappropriate institutional changes taking decision making away from local communities to distant national or regional centers.[23]
- Degradation of the urban and peri-urban environment resulting from industrial pollution[24], urban disintegration, lack of maintenance of urban infrastructure and services, and fast and chaotic urban growth.

In the current complex and interdependent world, original causes of impoverishment may rest in global decisions at national or international levels far away from the sites where it manifests. For instance, the debt burden is a major source of impoverishment, but its origins can be traced to international economic and trade events in locations far removed from the communities and population sectors affected.

THE DEBT BURDEN

The story begins in the early 1970s, when sharp increases in oil prices resulted in booming trade surpluses for the oil-exporting countries. A significant fraction of this surplus was deposited in international banks together with an increasing flow of dollars stemming from the U.S. international trade deficit. The banks, in turn, promoted an aggressive policy of money lending at floating interest rates, in many cases to governments and enterprises of developing countries.

The picture began to change radically in the mid-1970s. The world's economic and trade prospects deteriorated, the huge U.S. public deficit was financed by a dramatic inflow of foreign resources, made available by an increasing interest rate that grew to four times its historical level. Availability of fresh loan money to Third World countries diminished abruptly and the paying capacity of Third World debtors was handicapped by worsening trade prospects, rising interest rates, the above-mentioned reduction in the availability of new loans, and poor management of the resources obtained through former indebtedness.

As governments of the South turned to austerity policies in order to face the repayment of their foreign debts, the poor have been among the first to suffer the consequences, since many public programs and services (food subsidies, health services, housing programs) were severely curtailed. Subsidies to the rich continued in order to encourage

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[22] Agarwal, A. "Beyond Pretty Trees and Tigers: The Role of Ecological Destruction in the Emerging Patterns of Poverty and People's Protests", ICSSR Newsletter 15 (1) (1984), pp. 1–27; and Gutman, P. "Desarrollo Rural y Medio Ambiente en América Latina." Buenos Aires: Centro Editor de América Latina, 1988 (Chapter 5; sections 9 and 10).

[23] Bocking, S., R. Bocking and C. S. Holling. "Impoverishment and Renewal". Report to IDRC, Vancouver, Canada, 1988.

[24] This is today mostly concentrated in the industrialized countries, but it is growing quickly in the South. The problem in the latter is compounded by the increasing export of polluting industries from the North to the South, where legal regulations are weaker and often not enforced, and where the local populations are more vulnerable.

investment (tax cuts, higher internal rates of interest, etc.). The poorest sectors suffered from a regressive distribution of income, and environmental concerns were often forgotten.

Sources: Jolly, R. "Poverty and Adjustment in the 1990s." In J.P. Lewis et al. *Strengthening the Poor: What Have We Learned?* Oxford: Transaction Books, 1988, pp. 163–175; Avramovic, D. "La Deuda de los Paises en Desarrollo a Mediados de los 80." In *Comercio Exterior*, 37(4) (Mexico, 1987), pp. 259–274; Ferrer, A. "Deuda, Soberania y Democracia en America Latina." In *Comercio Exterior* 34(10) (Mexico, 1987), pp. 988–993; French-Davies, R. "La Crisis Financiera Internacional y el Tercer Mundo: Gestación, Emergencia y Perspectivas." In *Comercio Exterior* 34(10) (Mexico, 1984), pp. 939–944; McWilliams Tullberg, R. 1987. "La Deuda por Gastos Militares en los Paises en Desarrollo No Petroleros: 1979–1982." In *Comercio Exterior* 37(3) (Mexico, 1987), pp. 196–203; Mexico; PREALC. "Ajuste y Deuda Social: Un Enfoque Estructural. Santiago de Chile, 1987; and Riter, A.R.M. y D.H. Pollock. "La Crisis de la Deuda Latinoamericana: Causas, efectos y perspectivas." In *Comercio Exterior* 37(1) (Mexico, 1987), pp. 18–26.

Impoverishment and Sustainability

The eradication of poverty – both as a goal in itself and as a necessary component of sustainable development – requires broadening the scope of the poverty issue from a state to a process, and from economic, social or cultural impoverishment to impoverishment of the whole socio-ecological system, including the human or societal subsystem and the ecological subsystem, as well as their mutual interactions and their linkages with the external environment (including other socio-ecological systems). Poverty eradication programs should aim not at short-term income amelioration but at placing the target population on a path towards sustainable development. Focusing on the socio-ecological system allows new questions to be posed regarding the dynamics of impoverishment, the links between local and global processes, and the relationship between poverty and sustainable development.

Socio-Ecological Systems

A socio-ecological system refers to any system composed of a societal (or human) component and an ecological (or biophysical) component. Socio-ecological systems may be urban as well as rural. While the urban ecological system is largely artificial, it still has a biophysical dimension. Environmental conditions and their effects on the urban poor, as well as the environmental impact of the latter, are important issues for the eradication of poverty.[25] Socio-ecological systems exist at various levels, ranging from the local (a household in interaction with its surroundings) to the global (consisting of all of mankind and the ecosphere).

Figure 1 summarizes a set of questions designed to generate understanding and action in relation to impoverishment or sustainability issues in any socio-ecological system.[26] In general, interactions between society and nature take place through two sets of activities: *human actions* that impinge upon the natural ecological systems and the *ecological effects* generated in nature (spontaneously or in response to human actions) that impinge upon the social system. These interactions cannot be properly understood in static terms, or through traditional inventory or survey approaches.

What actions humans take to affect the ecological system depends on how the society functions and on its perception and evaluation of the environment. Different socio-economic actors affect the environment in different ways; it is therefore necessary to take into account *who acts upon the environment.*

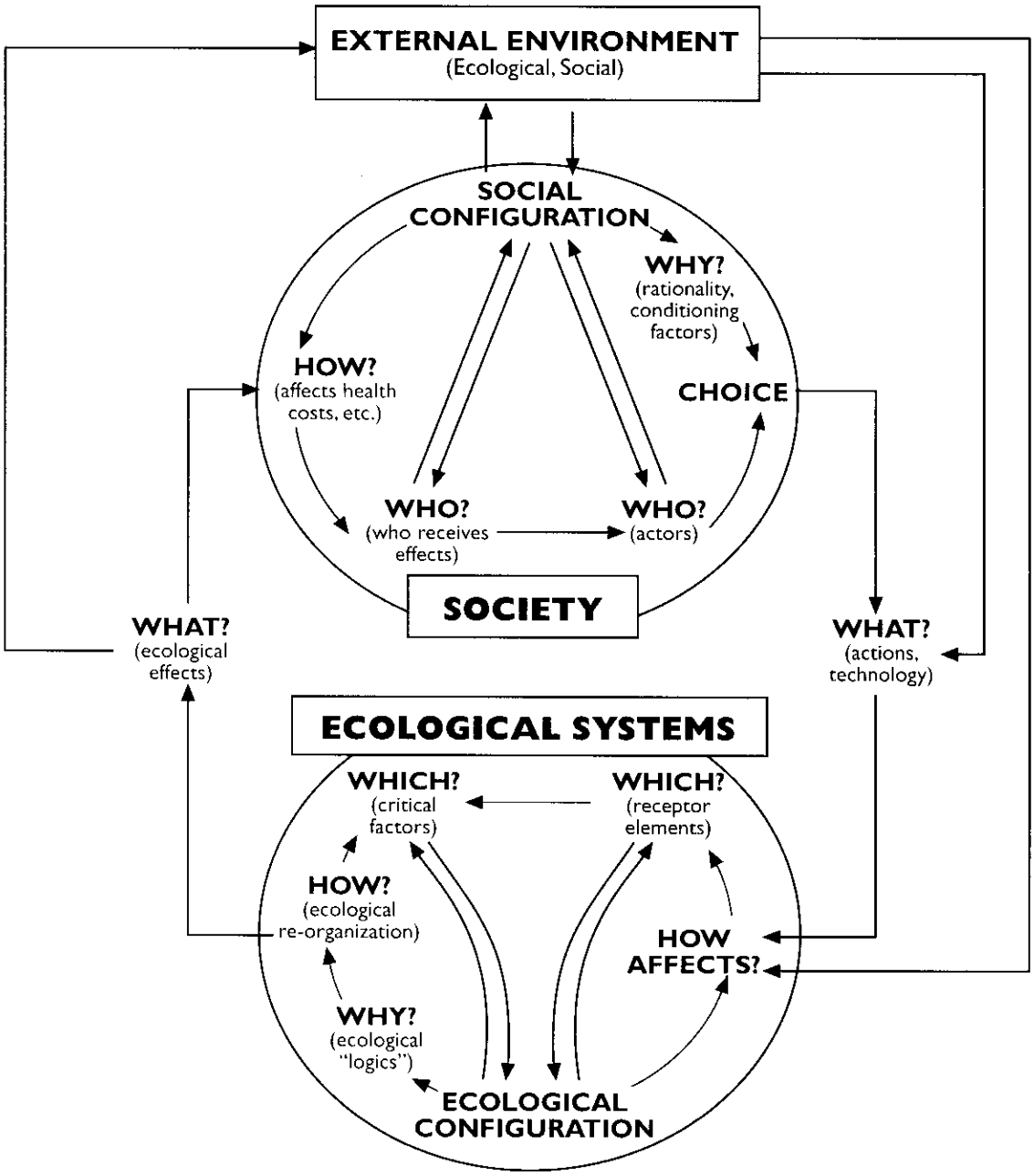
Individual and collective actions are rarely whimsical or random; rather, they respond to some type of logic or rationality. It is therefore also necessary to consider *why particular actions impinging on the environment are being carried out.* Such actions can be taken for a variety of reasons (ignorance, convenience, lack of alternatives, perception of the situation, etc.); why they are done and how

[25] Campbell, T. "Environmental Dilemmas and the Urban Poor." In Leonard, J. et al. *Environment and the Poor: Development Strategies for a Common Agenda.* Washington, D. C.: Overseas Development Council, 1989, pp. 165–187.

[26] Gallopin, G. C., P. Gutman and H. Maletta. "Global Impoverishment, Sustainable Development and the Environment: A Conceptual Approach." *International Social Science Journal* 121 (1989), pp. 375–397.

Figure 1

Guiding questions in the analysis of socio-ecological systems



they are carried out depends on the particular actor's circumstances and history, as well as the "social configuration" that strongly conditions its effective options.

"Social configuration" refers here to the complex interrelationships among the socioeconomic, political, and ideological structures in which individuals and groups strive together. The boundaries of a particular social configuration can be national, international, or subnational. "Socio-economic" refers to all processes and social relations directly oriented to the social reproduction of human life, including demographic processes, production and distribution activities, and related institutions. "Political" alludes to the full range of power relations, where power may be based on varying combinations of force and legitimacy. "Ideological" includes the social and cultural apparatus for developing and transmitting ideas, values, and knowledge. Political domination and ideological hegemony are strongly linked to the economic structure of society, particularly appropriation of the means of production and the resulting rights to the product of labor.

It is also important to consider *who is most likely to suffer or benefit* from changes in the ecological subsystem. Frequently, the groups, sectors, or social actors most directly affected by the ecological consequences of human actions are not those who generate them. Who is affected depends in part on the nature of the effects and in part on the social configuration. In addition, the social configuration is affected differently depending on who receives the effects. Ecological changes affect people in different ways (diminishing production, health damages, increases in costs) depending upon where the population is located, what its productive activities are, general living conditions, and numerous other factors (for instance the vulnerability to epidemics is related to the nutritional level of the population). What is also needed is an analysis of *how ecological changes affect the human system*; in other words, how do a set of ecological effects translate into beneficial or deleterious impacts upon society.

In contrast, the response of the biophysical environmental system to human actions is governed by quite different factors and processes. From the ecological side, it is necessary to understand *how human actions impinge upon natural systems* (e.g., elimination or introduction of species, biomass extraction, drainage alteration, introduction of toxic chemicals, etc.), and *what specific ecological effects are produced* either spontaneously or in response to human actions.

The impact of human actions upon ecological systems depends upon the nature of the action and upon the *ecological configuration* (e.g., the same rate of extraction of individual organisms could stimulate the growth of a given biological population or could lead to its extinction, depending upon the productive state of the population, the previous history of the ecosystem, the other species present, etc.).

Since human actions can impinge on many different elements of ecological systems, it is necessary to consider *which* are the receptor ecological elements that are directly affected by those actions; this depends partially on the ecological configuration (for instance the spraying of an area with pesticides will affect the soil fauna in open ecosystems directly, but in dense forests the primary receptors could be the insects in the upper canopy; hydric pollution could initially reach different groups of plants or animals depending on the circulation of water and the

distribution of organisms, etc.). The effects suffered by the receptor elements can be transmitted to the rest of the ecosystem, producing alterations in the total ecological configuration (e.g., organochloride pesticides can accumulate to lethal doses in carnivores through food chain concentration; the elimination of dominant plants can stimulate the proliferation of other, previously rare, species).

Because effects reverberate through the ecosystem, it is also necessary to know *which ecological elements, linkages, or functions will determine the final ecological effects.* These critical factors may be the same as the receptor elements, but often they are other variables, being affected through indirect pathways.

In order to understand *how* reorganization of the ecological systems occurs (a reorganization that generates some of the ecological effects impinging upon the human system), it is necessary to infer not only which critical factors are modified but also *why the reorganization occurs.* This depends upon the "ecological logic" inherent in the given ecosystemic configuration (for instance, in many tropical rainforests the nutrients accumulate primarily in the living biomass rather than in the soil; as a consequence, the replacement of the rainforest with crops often leads to the rapid leaching of nutrients, causing the land to lose its fertility within a few years).

Finally, the most relevant links with the *external environment* must be identified and analyzed. This includes not only interactions between the external environment and the societal configuration (and through it the ecological subsystem), but also actions by agents in the external environment that impinge on the biophysical environment of a given society ("enclave" resource exploitation, actions of war, etc.). In addition to these kinds of actions, certain natural changes (either spontaneous or due to human actions generated in the external environment and exerted outside the territorial area considered) could affect its ecological systems (e.g., species migrations, acid rain, global pollution, global climatic changes, alteration of oceanic currents, downstream water pollution, etc.). By the same token, some spontaneous or human-induced ecological effects arising within the ecological systems of a given society can impact its external environment.

Together, these questions represent a basic framework for understanding the relationships between society and the natural environment; this framework is useful for the study of poverty and impoverishment and for the identification of remedial actions. Causal explanations are necessary to assess how rigid or flexible various actions are, and for identifying the means to modify them, if necessary. For instance, if the fundamental cause of social or environmental degradation in a given situation can be traced to lack of knowledge, appropriate measures would include research or education; when the problem is due to narrow economicist interests, a completely different set of measures is appropriate. On the other hand, in some situations improved knowledge of the causal dynamics of the ecosystems could help to alter the ecological response without much altering human actions; similarly, new knowledge could point to changes needed in human actions to prevent damage that would otherwise occur.

Although this volume focuses primarily on the poor and on those subjected to impoverishment processes, all of the above questions should be taken into account. In particular, questions related to the *choices* made by various social actors should

be explicitly considered in order to identify what influences systemic change and impoverishment processes. This includes examining decision-making at the local or micro level (where the direct interaction between society and nature occurs) as well as at higher (national, international) levels which affect local socio-ecological systems but are not directly exposed to the immediate consequences.

Socio-Ecological Impoverishment

Taking into account the multiple interrelations of social and natural processes helps to advance a generalized concept of socio-ecological impoverishment. Impoverishment in the *human* subsystem can result from one or a combination of changes at the following levels:

- Reduction in the availability or value of the resources (economic, human, ecologic, etc.) necessary to generate the satisfiers of human needs, desires and aspirations. Examples include loss of the land, ecological degradation of agricultural or grazing land, increased prices for the means of production, changing market demands making obsolete previous skills, loss of access to channels of interactions with the outside, lowered prices for their agricultural products, encroaching of commons lands by privatization, death of livestock by drought or floodings, lowered wages for labor, etc. Sometimes this may be masked by a transient "enrichment" originated from the selling of the land or means of production (not a genuine income, but a product resulting from de-capitalization).
- Reduction in the capacity of the human subsystem to make adequate use of resources it has available. Examples include prolonged illness or malnutrition reducing people's capacity to work the land, reduced access to information about prices and legal rights.
- Reduction in autonomy to use the resources and make decisions. Examples include new legal impediments, increased exploitation or pressures from the powerful and the intermediaries, reduced control over the means of production, increased debts, loss of cultural identity by imposition of external values.
- Reduction in the capacity to respond to internal and external changes. Examples include decreased buffers against contingencies; reduced capacity to adopt new technologies or to shift to new products; reduced capital, skills, or means of production to confront ecological changes such as climatic variations, declining soil fertility, or invasion by plagues.
- Reduction in the capacity for future improvement or maintenance. Examples include increased foreclosure of options; increased or prolonged overexploitation of resources; increased unproductive consumption; destruction of the social and cultural fabric, leading to disempowerment and further future impoverishment.

Impoverishment (or degradation) in the *ecological* subsystem can result from one or a combination of changes at the following levels:

- Reduction in the ecological productive capacity. Examples include degradation of the biotic or abiotic components of the ecological subsystem, such as destruction of biomass by pollution, overexploitation, or pests; degradation of the soil by erosion, loss of fertility, salinization, nutrient loss, changes in the availability of water, or climatic changes.
- Reduction in the homeostatic capacity of the ecological subsystem and in the ecological capacity for adjusting to new internal and external changes. Examples include weakening or destruction of buffers and self-regulating mechanisms, break-down of nutrient cycles and energy flows, drastic alterations in species composition and in the interactions between species, destruction of the reserves for renewal, increased fragility and vulnerability, and loss of resilience.
- Reduction in the evolutionary capacity of the ecological subsystem. Examples include loss of germplasm and of general ecological variability, and increased simplification and homogenization of ecosystems due to management or to increased environmental stress.

Access to Options

A study of resource use in relation to the socio-economic status of rural producers in the Argentine Chaco region suggests that the poorest and richest actors caused greater environmental damage than actors with intermediate status.[27] The numerous poor overexploit just to subsist. The rich, particularly large corporations, are motivated to maximize profits at the expense of sustainability since their capital can be diverted to new investments once a resource is exhausted. In the middle remain local, smaller-scale businesses with both a stake in sustaining the resources they rely on, and the ability to do so. While this situation should not be over-generalized (since counter-examples can be found in other parts of the world), it does appear to be fairly common.

This is another manifestation of the shared impact that affluence and poverty have on the environment. The high per capita material consumption of a minority of mankind is putting an immense stress on the environment, while the desperate struggle for survival of the poor population also contributes to environmental (and social) degradation.

In general, it can be said that environmental degradation associated with poverty is basically due to the poor's lack of options (lack of access to means of production such as land and equipment, lack of access to commerce, lack of education, low or no access to public services, and marginalization from the decisions that affect them). The wealthy, on the other hand, have many options, and they have access to the megatechnologies, to capital, and to power. Indeed, in some cases the rich may be said to have too many options, insofar as they may be able to override or ignore legal regulations, exploit other groups, or influence large-scale decisions.

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[27] Gallopín, G. C. and C. A. Barrera (preprint). "A semi-quantitative mathematical model of the interactions between ecological and socio-economic factors in the Chaco province (Argentina)." Fundación Bariloche, Argentina.

Different forms of redistribution within and among countries have been tried or are being proposed to eradicate poverty and foster sustainability. Today, transfer of technology, and of financial resources, are considered necessary measures for sustainable development. From a wider perspective, it can be said that these are examples of a generalized need for a transfer of options from the have to the have-nots, for the common benefit of all.

However, if specific measures foreclose rather than enlarge the available options, they can be counterproductive. For instance, transfer of technology without simultaneous elimination of certain perverse international economic mechanisms that generate dependency will not be conducive to sustainable development. Capital flows provided without attention to social and environmental concerns have a history of generating environmental degradation and social polarization in many developing countries.

Focusing on access to options (either by transfer or, better, by endogenous generation and widening of the repertoire of options) can offer a new perspective. The determinants of a poor community's or a poor country's options are not all financial or material in nature.

Replicability of Solutions

The degree to which poverty eradication and sustainable development programs and strategies are replicable, or can be generalized to whole regions or even to the whole planet, is an important issue.

As noted earlier, consumption patterns in industrialized countries cannot be sustained in the long run and a *fortiriori* cannot be extended to the rest of the world. Moreover, the sheer magnitude of the urban explosion in the South compounded by the backlog of unattended needs means that the replicating in the South of the approaches now used in the North (even if the Northern model were accepted as desirable) would only increase the prevailing inequity, benefiting a minority and marginalizing the majority of city dwellers.[28]

Often, poverty eradication and sustainable livelihood programs can only work if restricted to a small proportion of the poor population. This may be due not only to the high unit cost involved in many projects but also, in some cases, to the very "success" of those projects. Sometimes well-integrated, socially acceptable, economically efficient, and ecologically sustainable practices are simply not replicable at the aggregate level.

The Andean highlands of South America provide an example.[29] In this area, a technology of "micro-basin management" has slowly emerged; this approach, which combines a number of technologies, restores and preserves the mountainous environment while allowing the growing peasant population to live

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[28] Sachs, I. "Equitable Development on a Healthy Planet: Transition Strategies for the 21st Century." Synthesis report for discussion, the Hague Symposium on "Sustainable Development: From Concept to Action". The Hague, Netherlands (November 25–27, 1991). United Nations Conference on Environment and Development and the United Nations Development Programme, Government of The Netherlands.

[29] From Maletta, H. "Macroeconomic Constraints on Soil Conservation in Andean Peasant Agriculture." Report to the Ecological Systems Analysis Group, S. C. Bariloche, Argentina (1988).

more comfortably off it.[30] It includes such techniques as terracing and contour-plowing, construction of raised fields and infiltration ditches in the high plateaux, tree-planting for protection purposes on the slopes and gullies, grass planting along canals, better water management through irrigation and improved infiltration, seed improvement, and the development of small-scale industries for processing agricultural products and producing scarce inputs. While most of the individual components of this emerging technological package are quite well known, its uniqueness results from the systemic approach to whole basin management, in contrast to "sectoral" approaches that tend to concentrate on one aspect to the detriment of others.

The kinds of technical improvements usually recommended in micro-basin management programs have outstanding results, both economic and environmental. The mere introduction of terraces without any other technical change (i.e., with the same traditional crops, no use of fertilizers, etc.) can dramatically reduce soil erosion on the slopes, while simultaneously raising yields by 20 to 50 percent through better and longer retention of water in the soil and slower erosion; switching to other crops (e.g., vegetables and fruits) or to better seeds for traditional crops (corn, potatoes, wheat or barley) may do wonders; agricultural net income can easily be five to ten times as large as before.[31]

The investment cost is surprisingly small, amounting to about 300 days of work for terracing one hectare (which is usually more than a typical peasant family owns in the first place), and that amount of labor at local wage rates is often worth $300 to $600. Other related costs (small irrigation schemes, technical assistance, etc.) add up to about $1,500 per family. This is far below the standard costs (ranging from $5,000 to $25,000) of many conventional integrated rural development projects based on Western technologies (that often also damage the environment).

The small-scale credit needed for such endeavors is seldom available; the technical assistance required to learn the new techniques is also scarce. But even when these obstacles are overcome, the diffusion of these "new" techniques (which are mostly very old) often encounters an unexpected hindrance on the marketing side. The increased amount of agricultural produce resulting from such innovations must be sold in the market, and the market appears to be quite small.

Roads are seldom built in remote peasant areas, thus increasing transportation costs and putting peasants at the mercy of truck drivers and middlemen; on the other hand, urban populations are as impoverished as the peasants, depending on government subsidies to avoid starvation and putting fruit and vegetables in the category of luxuries. Per capita consumption of fruit, beef, vegetables, domestic dairy products and other such "luxuries" is stagnant or declining in Andean

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[30] Alfaro, J. and A. Cardenas. "Manejo de cuencas: Hacia una nueva estrategia del Desarrollo Rural en el Perú." Lima: Fundación Friedrich Ebert, 1988. and CEPAL (United Nations Economic Commission for Latin America). "Gestión para el desarrollo de cuencas de alta montaña en la zona andina." Santiago de Chile: ECLA, 1988.

[31] Alfaro, J. "Conservación de suelos y desarrollo rural en los Andes peruanos." In: J. Portocarrero-Maisch (ed). *Andenería, conservación de suelos y desarrollo rural en los Andes peruanos.* Lima: Fundación Friedrich Ebert, 1986 (sec. ed.); Alfaro, J. and A. Cardenas. *Manejo de cuencas: Hacia una nueva estrategia del Desarrollo Rural en el Perú.* Lima: Fundación Friedrich Ebert, 1988; Ministerio de Agricultura. *Manual técnico de conservación de suelos.* Lima: Perú. Ministerio de Agricultura, Programa Nacional de Conservación de Suelos y Aguas en Cuencas Hidrográficas, Convenio Perú-AID 527 0220, 1984; and Torre, C. de la, and C. Burga (eds.). *Andenes y camellones en el Perú Andino.* Lima: Consejo Nacional de Ciencia y Tecnología, 1986.

countries;[32] imported food often comes at dumping prices from food-surplus countries such as the United States or European Community members, and national governments often sell them even cheaper to local consumers or food-processing concerns.

The supply impact of improved techniques of soil conservation and agricultural production in the Andes is surprisingly large. A relatively small area adopting them can often double the national production of, say, cabbages or carrots. With effective demand on the slack side, transportation costs high, agricultural prices low, this inevitably ruins proposed schemes of agricultural development. In 1988, peasants in the Dutch-sponsored PRODERM project in Cuzco (Peru) got a potato yield three times higher than in previous years, but their net income was less than ever before due to extremely low prices during Peru's macroeconomic troubles of 1987–1988.[33]

The technologies that could both protect the environment and increase the peasants' income and living standards thus may become economically unfeasible under the impact of overwhelming macro-economic constraints. They are not intrinsically economically unfeasible; rather, distortions in the economic system make them difficult to apply.

The issue of replicability lies at the heart of the top-down versus bottom-up alternatives to development. If poverty eradication efforts were completely replicable and generalizable, broad macro-policies could be devised to attack the problem. Complete lack of replicability, on the other hand, would imply that the solution to the problem of global poverty and the shift to sustainability could only be reached through the cumulative efforts of a large number of local activities; macro-policies (other than those designed to remove impediments to local communities) would be either unhelpful or counter-productive.[34]

In most situations, however, both local strategies and macro-policies are required. Solutions must be tuned to local social and ecological realities, but also must be replicable at the broader macro level.

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[32] Food and Agriculture Organization (FAO). "Food Balance Sheets and Per Capita Food Supplies, 1961 1977." Rome: FAO, 1979; and FAO. "Food Balance Sheets, 1979-1981." Rome: FAO, 1984.

[33] Personal communication from PRODERM director Robert Haudry to Héctor Maletta, June 1988.

[34] Rahnema, M. "Global Poverty: A Pauperizing Myth." *Interculture* 24(2) (1991), pp. 4–51.

The need for Systemic Approaches

Impoverishment, both human and environmental, is a complex process with many causes and many connections with other processes. It is inappropriate to assume that any single factor is the sole reason for impoverishment, and equally inappropriate to think that fixing any one factor will solve the problem. There are no simple solutions.

The search for simple solutions and the application of narrow, independent, or piecemeal projects to parts of the problem have consumed vast amounts of money and humanpower, but have achieved limited headway against global impoverishment. It is time to look for long-term, sustainable solutions that take account of the inherent unpredictability and interconnectedness of complex socio-ecological systems. The concept of sustainable development, in contrast to the "use up and move on" mentality that has prevailed for so long, implies a form of development that preserves the renewal potential of natural resources, people, and institutions. It will not be found by considering economic, agricultural, educational, or other factors alone, but only through an integrated examination of societies, their environments, and their impacts on each other.

Indeed, the term "system" generally stands for a set of things (elements, parts) and a *relation* (set of interlinkages, interconnections) among the things. Each of the elements may be viewed as a subsystem of the whole system, and the system itself may be a subsystem of a higher or broader system.[35] Understanding a system requires understanding not only the elements that constitute the system, but also the pattern of linkages, in order to determine the way each element of the system affects and is affected by others and by factors external to the system. The behavior and properties of a system arise not merely from the properties of its component elements, but to a large degree also from the nature and intensity of the dynamic linkages among them.

Complex, interlinked problems require integrated approaches and solutions. In contrast with the prevailing analytical approach (which emphasizes the detailed study of isolated parts and the reduction of a system to its basic constituent elements), systems approaches address systems as wholes with their own complexity and dynamics. Systems sciences emphasize the study of relational properties which are valid for different classes of systems; in doing so, they use a variety of tools (e.g., simulation modelling, stability analysis, set theory) appropriate for studying integrated dynamic totalities.

The limitations of sectoral or analytical approaches are shown by the variety and multiplicity of failed development projects. An exploratory comparative analysis of systemic interlinkages in three case studies of impoverishment in Mexico, India and Madagascar highlighted the variety of factors and linkages affecting impoverishment.[36] In each of these instances, purely sectoral or analytic approaches would be seriously limited in terms of promoting either understanding

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[35] Moreover, the system's elements, their linkages, or both, may evolve through time or change drastically and suddenly.

[36] Penchaszadeh, Analia. *A Comparative Analysis of Systemic Interlinkages in Three Case Studies of Impoverishment.* Technical Report. Winnipeg, Canada: International Institute for Sustainable Development, August 1992.

or action, although they could be useful in providing detailed information on specific aspects of the problems.

The same is true for the current historical context where impoverishment is taking place, which exhibit the following traits: accelerated processes of social and ecological change and reorganization; growing connectedness between social and ecological systems (at the local and global levels); growing scale and impact of human actions on social and ecological processes; increasing interdependence between nations and between local and global processes; increasing complexity of social, economic, and political systems at national and international levels; and the strong non-linear way in which factors and relationships interact to determine social and ecological systems dynamics.[37]

These traits are characterized by change and non-equilibrium, connectedness, complexity, and non-linearity are the leading attributes underlying those traits. It is for this reason that focus must shift from the static concept of poverty to the dynamic processes of impoverishment and sustainable development within a context of permanent change. The dimensions of poverty can no longer be reduced only to conditions of living; the capacity to respond to changes, and the vulnerability of social groups and ecological systems to change, become central.

The magnitude of world impoverishment has reached a level where it demands solutions that will work and that will last. A systems approach can provide a unified description of social and ecological impoverishment with which to start. The search for solutions may have to draw upon highly technical methods, some of which were developed for the study of chemical, ecological, and social systems, and it will need the cooperation of specialists from different disciplines as well as political and institutional support. But the search itself has to begin where the problem is, in partnership with the people affected and in collaboration with, not control of, the environment. Many solutions to local problems have already been found and put into practice on small but successful scales. There is great potential for such small-scale solutions to spread, modified to suit local conditions, resulting in dynamic, resilient solutions to larger problems. A systems approach can help apply local perspectives to complex problems; it can also provide the same sort of insight to situations beyond the reach of local initiative.

Development projects fail for many reasons, most of them reflecting some property of systems behavior that was not taken into account. Too narrow, short-term, or rigid a viewpoint, like that of most development banks, is a common shortcoming. It almost always dooms a project to failure because it ignores the dynamic properties inherent in socio-ecological systems.

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[37] Implying, for instance, that small causes can generate large effects, that the result of many small changes may be much more or much less than the sum of their individual impacts, and that too much of a good thing can sometimes lead to unexpected catastrophes.

Drought in the Sahel: A Solution Gone Wrong

The following example illustrates the kinds of problems that can arise from well-intentioned but badly designed development efforts.[38] In 1984, televised images and newspaper stories from the drought-stricken Sahel in Africa shocked the world. They mobilized an extraordinary groundswell of support for relief, not just from governments and relief organizations, but from ordinary people. From every walk of life, in countries around the globe, people raised money to help. Unfortunately this help did little good, and in many cases made things worse in the long run.

For most people, the problem seemed to be simply a climatic one, and thus the solution obvious: supply water, dig wells. However, things were not quite that straightforward. While there was indeed a lack of water, it was no worse than the area had experienced and survived in the past. The Sahel has fragile soils and has always been subject to a harsh climate, but both the pastoral communities and the farmers had originally evolved ecologically rational ways of dealing with them. Their wonderfully adaptive system began to unravel in various parts of the Sahel for different reasons: two centuries of civil strife in Ethiopia, colonial policies in Kenya, importation of large-scale mechanized agriculture in West Africa, and everywhere a shifting emphasis on cash crops for export instead of food for local consumption. Population increases expanded cultivation northward to the less productive grazing lands used by pastoralists, disrupting their migratory habits, and encouraging them to settle around wells. The net result of the loss of traditional husbandry was enormous stress on the land.

Drought in itself does not usually cause desertification. It can certainly aggravate it, but the Sahel had gone through many droughts before (it is after all a semi-arid region) and had recovered without becoming a desert. The real causes of desertification are overgrazing, overcultivation of poor soils, watershed deforestation, overharvesting of fuelwood in drylands, and inappropriate irrigation methods. All of these practices were going on in various parts of the Sahel. When drought reappeared, it was simply more than the land could take. The resulting catastrophe prompted foreign countries to help. But what did they really do, besides continue to sell arms to Ethiopia and Sudan?

The Sahel illustrates how the lack of a systemic approach to foreign aid creates problems. One of the first things foreigners did was dig wells and distribute food. Water and food distribution centers gave people incentive to stay around those centers. However, neither the land nor the water table could support such large densities of people indefinitely, so the result was masses of people, completely dependent on outside sources of food and water, concentrated in areas made truly barren by human impact. Western aid built thousands of wells all across the Sahel, so pastoralists would not have to go in search of water. However, it was their migrations that prevented their herds from overexploiting the grasslands. Staying in one place, near the wells, the animals quickly overgrazed and trampled all the

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[38] Bocking, S., R. Bocking and C. S. Holling, *Impoverishment and Renewal*. Report to IDRC, Ottawa, Canada, 1988, pp. 16–30.

surrounding vegetation. A further result of all these wells is that the Sahara aquifer is disappearing.

One third of foreign aid in the Sahel went to projects that would increase agricultural production, with most of it for Western style, large-scale, chemical-intensive agriculture geared to the export market. Agricultural aid often resulted in pastoral land being turned over to agriculture, excluding migrants in order to protect crops, even though nomadic pastoralism is the only sustainable method of husbandry in sub-Saharan lands.

Another response of aid agencies to the drought crisis was to help raise the productivity of livestock; these projects also made things worse, this time by increasing cattle populations to unsustainable levels.

These piecemeal projects ignored the needs of the peasants, ignored the financial drain of ongoing costs for poor governments, and ignored the needs of the land. Moreover, they left the governments increasingly at the mercy of outside market forces and contributed to the further breakdown of traditional social systems and their inherent adaptive capability.

Billions of dollars in aid have been sent to the Sahel. The massive commitment to combat desertification has accomplished precious little because it has not taken a systemic approach to the whole problem or recognized its long-term nature. Each solution only treats part of the problem and, ignoring connections and feedback, often makes another part of the problem worse. In doing so, it decreases the resilience of the whole system.

The single-minded, narrow approaches of different groups of experts acting independently in the Sahel has led to increasing desertification, and malnourished human populations totally dependent on foreign aid for sustenance. In addition, there is growing evidence that the changing surface reflectivity of this vast stretch of semi-arid land, a result of the desertification, may actually be changing the African climate so that the Sahel will become permanently drier. The region may have crossed a threshold into a new regime, one of extreme aridity.

Local initiatives, which may seem backward or provincial to outside experts, usually are based on better understanding of the problem. For example, in 1976, one man responded to drought and associated unemployment among the Mossi people of Burkina Faso by reviving a regional tradition of self-help and village-level cooperation. He started an organization called 'Six-S' (short for 'se Servir de la Saison Sèche en Savanne et au Sahel'), which teaches village group leaders new techniques and provides funds through informal arrangements. Using traditional systems and local creativity, Six-S has developed self-reliant and mutually reinforcing solutions to drought and poverty that include vegetable gardening, irrigation and drainage, erosion control and afforestation, as well as primary health care and education. German and Swiss groups provide financial backing, but specific management is always left up to local groups.

These village groups have grown into one of the largest community development movements in Africa. There are now more than 2,000 groups and the movement has spread beyond Burkina Faso to other nations in the Sahel.

Projects that are supposed to alleviate poverty are very prone to failure when they follow a "bigger is better" approach. Large-scale, foreign-planned agricultural projects in Africa have not succeeded in helping the poor, but they all consumed a lot of money. They failed because they never looked beyond a single objective: grow something for money, and if possible grow lots of it. This objective, unlike that of the Six-S projects, never considered the viewpoint of the people it was supposed to help, never considered the suitability of the project for local resources, never looked at the long term.

Large-scale water and energy projects almost invariably make the same mistakes – only on a larger scale. Moreover, the mistakes usually are irreversible and close off many alternative options at the same time. Big water projects have enormous impacts. They flood a lot of land, displace many people (as many as one million in the case of the Narmada Dams in India), cause tremendous social upheaval, and have major impacts on the environment. Most of them are not even justifiable from a purely economic point of view. This is in sharp contrast to a water project created by villagers in the Yatenga plateau of Burkina Faso. They improvised on Israeli scarce-water techniques taught to them by Oxfam workers and came up with a 'contour damming' method of capturing rainwater runoff for irrigation. It uses inch-high contour ridges made of twigs or stones, costs virtually nothing but local manpower, and is uniquely adapted to local conditions.

Sometimes traditional approaches to poverty fail because of unforeseen consequences. For example, few would deny that education has to be part of any long-term strategy for reducing poverty, but designing an educational policy to produce what is needed is not as straightforward as it might seem. Often the better educated among the rural poor head for the cities, searching for job opportunities lacking in the villages; the educated in the cities leave for other countries, or fail to return home after completing subsidized higher education abroad.

Systems Analysis: A New Approach to Defining the Problem

Classical approaches to poverty have clearly not worked. A major reason is that they have sought single – and simple – solutions to narrow problems, when they should have presented an integrated approach within a broad framework.

A systems approach – broadening the scope of the problem to include social and ecological dimensions, as well as the space and time scales[39] – can provide a unified description of impoverishment in the total system, including cases in which solving one set of problems brings impoverishment to another human group or to another ecosystem in different (even remote) places. This approach also provides a means of analyzing social, economic, and ecological impoverishment at different absolute

[39] The systems approach referred to here is not the classical systems engineering approach, but a dynamic and flexible holistic perspective, that can use, but is not limited to, quantifiable variables and relations, and mathematical models. It must be taken into account that some of the most essential variables and relations for impoverishment and sustainable development are not quantifiable in any meaningful sense (of course, it is always possible to put numbers and generate equations, but this brute force approach can be not only meaningless, but also misleading).

levels or different initial conditions (impoverishment in the industrialized countries as well as in the poor countries, impoverishment associated with development or enrichment processes), as well as the impact of different social actors, including not only the poor, but also powerful economic actors such as large enterprises, multinational corporations, etc.

If the socio-ecological system is not taken as a whole, misleading conclusions may result. For example, agricultural ecosystems could be seen as impoverished ecological systems (simplified, with reduced internal homeostasis and lower evolutionary capacity). When the continuous careful and integrated human manipulations are included in the picture, it becomes clear that the total system (under appropriate management) is not impoverished, but exhibits high productivity, stability, and homeostasis.

Systems analysis consists of both a) a way of looking at the world (a cosmo-vision) and b) a set of concepts and tools (some numerical, some non-numerical). Although the applicability of some specific techniques may depend upon the availability of highly precise and detailed numerical data, general systems analysis can help decision-making even in the low-information, high-uncertainty situations typical of development/environment problems all over the world. On the other hand, the use of systems analysis can also point the way towards the elaboration of new, comprehensive, systemic indicators needed to monitor and assess change in socio-ecological systems.

The quest for sustainable development and poverty eradication is certain to pose new challenges to systems analysis, possibly around the themes of self-organizing and evolutionary complex systems, the roots of systemic vulnerability/robustness, the treatment of multi-scale interlinkages, the treatment of interactions between simultaneously unfolding mega-processes, and the treatment of irreducible uncertainty and fuzziness.

Key Systemic Properties Affecting Impoverishment and Sustainable Development

The adoption of a systemic perspective helps to identify a core of basic attributes or properties of socio-ecological systems that are fundamental for understanding the processes of impoverishment and renewal. They go beyond the very important, but more obvious, of availability (or scarcity) of resources or services (economic, natural, or human). The attributes discussed here represent some of the root causes or underlying systemic properties associated with systems change, rather than symptoms or consequences. Therefore, their characterization and monitoring could be very useful for tackling the problem of impoverishment and sustainable development.

In order to avoid jumping into a specialized technical level, no rigorous definition of the concepts will be attempted here. Rather, they will be used somewhat loosely, as basic components associated with identifying and eradicating systemic poverty.

Adaptability and Flexibility

Adaptability means, in general terms, the capacity to adapt (i.e., to be able to live and reproduce) to a range of environmental contingencies, or to make the alteration or adjustment that will enable a species, population, or individual improve its condition in relationship to its environment.[40] For humans, it can be defined as the ability of the human system to maintain (or increase) the quality of life of individuals and/or communities at adequate values in a given (biophysical and socio-economic) environment or range of environments.[41] Thus adaptation to bare survival conditions (e.g., concentration camps, extreme poverty, chronic undernutrition, etc.) is a pathological condition, crippling individuals and communities. Indeed, one of the difficulties with the "absolute" measures of poverty is human facility to adapt to and survive in apparently intolerable conditions. Even with food intakes of less than 1,000 calories per day, many people could survive for years if not called upon to undertake hard physical work. But the levels of intake at which sheer survival become impossible are lower than anything that could decently be proposed in a measure of poverty.[42]

Adaptability has meaning in terms of both time and space, and it requires a degree of flexibility or plasticity, a capacity to be influenced. Its opposite, rigidity, diminishes the capacity to adapt to a changing environment, and can lead to the collapse of the socio-ecological system or of some of its subsystems. Impoverishment and environmental degradation often follow from the failure of migrants and settlers to adapt to new environments. For instance, in the Amazon, the difficulty of migrants and settlers in living off the resources of the region is compounded by their lack of familiarity with the new ecosystems and their

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[40] Dobzhansky, T. "Adaptness and Fitness. In R. C. Lewontin. *Population Biology and Evolution.* Syracuse: Syracuse University Press, 1968, pp. 109–121.

[41] Quality of life is experienced by individuals; the quality of life of communities or nations refers to the average value in the community or country.

[42] Rodgers, G. *Poverty and Population. Approaches and Evidence.* Geneva: International Labor Organization, 1984.

potential. Foods are imported while the highly nutritious goods native to the region go unconsumed, resulting in malnutrition due to the change in eating habits.[43]

However, infinite flexibility may not be a desirable attribute for sustainable development. If the system is absolutely pliant to the changing context, it can become subject to the vagaries of its external environment, to the detriment of its own goals or identity.

It is important to identify the range of (social and ecological) environmental conditions to which a given socio-ecological system can adapt, as well as how those conditions are changing (increasing or decreasing the adaptability of the total system or any of the subsystems). For instance, human-induced climatic warming is expected to change the conditions to which biological species, physical infrastructure, and human activities have become adapted or have been designed for. In some instances, adaptation to the new conditions may be either too slow or altogether impossible, leading to extinction of species and ecosystems, obsolescence of infrastructure, and changes in human activities.

The basic factors contributing to adaptability of individuals, communities, production systems, ecosystems, etc., when confronting changes in their environment or context or the need to move or expand to other environments, are important in themselves and, as components of the broader concept of capacity to respond, are discussed later.

Robustness, Resilience, and Stability

One of the most important characteristics of complex systems is that they are never static. Socio-ecological systems are always in a state of change. Some parts are increasing while others are decreasing; things come and go; they grow, die, and renew. In natural ecological systems, this natural variability is always bounded by various mechanisms of internal regulation and renewal.

Most environmental and human systems are quite robust, the proverbial "delicate balance of nature" not withstanding. Forests can recover from, even depend upon, periodic forest fires; animal populations can support substantial harvest rates by hunters and fishermen; humans can survive occasional food shortages; societies can rebuild after the devastation of war. Socio-ecological systems only become delicate when the conflagration or harvest or conflict is so severe or prolonged or frequent that it destroys the system's ability to renew itself.

For example, the California sardine populations could have supported significant harvests forever. The harvests would have been higher in some years, lower in others, but as long as they were reasonable, the stocks could rebuild and be harvested again. But when the fishermen continually hammered away, too long and too hard, at the stocks, their ability to recover was diminished. Technological improvements in fishing gear allowed continuing large harvests to be taken from

[43] Inter-American Development Bank/United Nations Environmental Programme/Amazon Cooperation Treaty (IDB/UNDP/ACT). *Amazonia Without Myths*. Washington, D. C.: (published by IDB, UNDP, and ACT), 1992.

decreasing populations, at first masking what was really happening with the fish. Ultimately, however, the stocks lost their resilience and collapsed.[44]

The recent outbreak of cholera epidemics in Latin America offer an example of what can happen as a result of gradually increasing vulnerability in the social system. As a result of the economic crisis of the last decade, public sanitation services had been poorly maintained and social expenditures had been continually reduced. Without this hidden vulnerability, the initial contagion might still have taken place, but it would not have reached epidemic proportion.

Sometimes a system can be brought back from the threshold and made resilient again. This happened in an isolated Peruvian valley where cotton had been grown for seventy years. When chemical pesticides such as DDT became available, farmers used them to get rid of seven insects that co-existed with the crops. The cotton harvest immediately increased by 50 percent. But a few years later, six new pests showed up, their enemies having been killed by the spraying. Then the original pests became resistant to the chemicals. This initiated an accelerating program of spraying. Before long, cotton yields were at their lowest, pesticide costs at their highest, and the farmers almost bankrupt. Finally, the farmers decided to change strategy. They drastically reduced the spray program, and introduced biological controls instead. The new policy reduced the amount of human control, and allowed the natural system to function more independently. As for the cotton, it flourished, with higher yields than ever.[45]

However, if a complex system is disturbed long, deeply, or critically enough, it may change so completely that it has a new structure and organization, one that persists even after the original disturbance is removed. This has happened with climate changes in the earth's geological past, and with man-made impacts in the historical past. The threshold for such an irreversible change is usually invisible; human activities resulting in small changes accumulate, and the resulting catastrophe comes as a surprise.

The concepts of dynamic stability, resilience, and robustness, refer to the capacity of complex systems (including socio-ecological ones) to maintain some degree of permanency in the face of the variable and unavoidable disturbances to which any system is always exposed. That permanency may refer to the maintenance of a "steady state" or dynamic equilibrium condition, to which the system tends to return. Often, in socio-ecological systems, what is preserved is a basic mode of behavior, a certain dynamic pattern of responses. If changes or disturbances are strong, persistent, or specific enough, the system may suddenly shift into a different mode of behavior, qualitatively different and sometimes rather stable or even irreversible.[46] If this new mode of behavior is undesirable or unacceptable, the

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[44] Bocking, S., R. Bocking and C. S. Holling. *Impoverishment and Renewal.* Report to IDRC, Ottawa, Canada, 1988, pp. 78–79.

[45] Bocking, S., R. Bocking and C. S. Holling. *Impoverishment and Renewal.* Report to IDRC, Ottawa, Canada, 1988, p. 162.

[46] Holling, C. S. "Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics 4 (1973), pp. 1–23; Holling, C. S. "Perceiving and Managing the Complexity of Ecological Systems." In United Nations University (UNU). The Science and Praxis of Complexity. GLDB2/UNUP560. Tokyo: UNU, 1985, pp. 217–227; Holling, C. S. "The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change. In W. C. Clark & R. E. Munn (eds). Sustainable Development of the Biosphere. Cambridge: IIASA/Cambridge University Press. 1986, pp. 292–317.

change in behavior is viewed as catastrophic. A mounting number of complex systems are demonstrating this capability of flipping between different stable regimes.[47]

Under certain circumstances, a system may suffer deep structural changes, resulting in a fundamental reorganization of the elements of the system and their interlinkages, the disappearance of some elements and the inclusion of others, etc. This type of change has been demonstrated even in relatively simple physico-chemical systems; it can involve evolutionary change associated with the emergence of true novelty as well as the possibility of "jumps" from a given systemic organization to a higher level of organization (more complex, more adapted, and better able to cope). A distinguishing characteristic of this type of change is that the new structure seems to be inherently unpredictable.[48] Human societies display many characteristic features of non-linear non-equilibrium systems: unpredictability, complex interdependencies, time-lags, transitions from one state to another, and the importance of a critical mass in producing and sustaining change. However, a theory designed to explain the collapse of social systems (and the emergence of new structures) would have to take into account the *interference* between spontaneous development and planned action.[49]

Robustness, resilience, vulnerability, and fragility as systemic concepts are discussed more technically elsewhere.[50] Here, it suffices to emphasize the general concept that complex systems possess mechanisms that maintain some degree of permanency in the face of changing circumstances, and that those mechanisms or processes may be inadvertently tinkered with or destroyed, with drastic consequences.[51]

In one sense, robustness and resilience complement and bound adaptability, since they represent ways of maintaining system's identity and integrity in the face of a changing world. These basic, generally not obvious, attributes can be eroding, without exhibiting changes in adaptability, until it is too late; or they can be nurtured to create the conditions that will allow the system to cope with disturbances in the system, or to generate radical amelioration.

Socio-ecological systems are not only complex self-organizing systems, they are self-conscious, purposeful ones. The social construction of the future, the eradication of poverty, and the change of course towards sustainable development require careful consideration of the processes determining vulnerability and robustness.

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[47] Gleick, J. *Chaos. Making a New Science*. New York: Penguin Books, 1988.

[48] Nicolis, G. and I. Prigogine. *Self-Organization in Non-equilibrium Systems: From Dissipative Structures to Order Through Fluctuation*. New York: Wiley, 1977; Prigogine, I. et I. Stengers. "La Nouvelle Alliance. Métamorphose de la Science.", 1979. Gallimard, Paris; and Jantsch, E. *The Self-organizing Universe*. Oxford: Pergamon Press, 1980.

[49] Mayntz, R. "Chaos and Social Order". WORK IN PROGRESS (United Nations University) 14(1): 5. (1992).

[50] Gallopín, G. C., P. Gutman and y H. Maletta. "Global Impoverishment, Sustainable Development and the Environment. A Conceptual Approach." *International Social Science Journal* 121 (1989), pp. 375-397; Gallopín, G. C., P. Gutman and H. Maletta, "Global Impoverishment, Sustainable Development and the Environment." A Report to IDRC; S. C. Bariloche, Argentina: GASE, March 3, 1989.

[51] The key word here is inadvertently. Deliberate modification of some of these mechanisms might lead to positive self-sustaining change, if the system is well enough understood. In some cases then, vulnerability might become positive or desirable.

Capacity of Response

The concept of "capacity of response" refers to the capability of the system to cope with change, both external and internal change. It implies active as well as passive adjustment, and it reflects the past history of the system.

Change is partially manageable, and partially unpredictable. The point is not to stop changes, but to understand where and how to flow with change in a way that channels the system towards a path of sustainable development (particularly when the system is approaching critical bifurcation points leading to impoverishment).

A socio-ecological system's capacity to respond is derived from its adaptability and its robustness and resilience; the ecological subsystem's capacity to respond may also lie in these same characteristics. But for the human subsystem, robustness and adaptability are not enough; the ability to retain or increase the number of available options to face a natural and social world in permanent change, as well as the capacity to make use of those options, are fundamental aspects of its response capacity.

The encroachment of modernization and commercialization on indigenous or peasant communities is an example of exogenous changes reducing the options of those communities. Sometimes future options are foreclosed by a community's or society's own actions.

Locking poor people within a development pattern that reduces the options for future change is nothing less than mortgaging their future. Options should not only exist at a theoretical level but should be concretely available to real people (individuals, households, groups). For people to have the capacity to cope with a changing environment, they need growing social awareness, higher levels of social participation, and understanding of the ecological processes of change and self-renewal.

A social actor's capacity to respond (whether that actor is a person, a family, or a group) depends upon a complex set of causes. While the causal factors vary from one case to another, some are central to increasing the capacity of a social group to respond when confronted with socio-environmental changes. *Increasing the resources available to the group* increases its capacity to respond. Similarly, *increasing awareness* can increase the capacity to respond. For instance, many ecological problems are not clearly visible and may not manifest themselves for some time. A degree of social awareness is necessary to avoid being trapped by such conditions. At a societal level, this requires freedom to conduct research, a rather flexible system of research funding, a good level of education, and free access to communications media. At the local level, access to information and a better understanding of the surrounding environment are needed to enhance the group's capacity to respond.

For the human or social subsystem, the capacity to respond is clearly related to the ability of the social actors to interact in a collaborative way.

Self-Reliance

Each self-organizing system has, because of its own internal organization and dynamics, a variable degree of autonomy over its own functioning, and of control over its environment and the environment of other systems. Self-reliance refers to a system's ability to regulate its interactions with the environment. It involves developing mechanisms to build up an inner capacity to define its goals, priorities, identity, and values. Self-reliance should not be confused with self-sufficiency, or with autarky.[52]

For some thinkers, self-reliance at local, national, and regional levels, implies "regenerating through one's own efforts," that is, the autonomy to set one's own goals and realize them as far as possible through one's own efforts, using one's own forces and economic factors.[53] It is a way of fighting domination by beginning to rely on oneself (both the individual and the collective self). It includes three basic ingredients:

- self-respect and self-confidence, that is, faith in one's own values, culture, and civilization (including both traditional culture and the potential and ability to create a new culture);
- self-sufficiency, in the sense of being able to produce what is needed to meet basic needs (absolute self-sufficiency is not required); and
- fearlessness, both as an attitude and as a structure of defense.

The practice of self-reliance is based on the principles of participation and solidarity. Self-reliance implies changing the direction and composition of trade and cooperation, not building tight impenetrable walls. The point is not to avoid interaction but to interact according to the criterion of self-reliance.

The search for self-reliance is not in conflict with the reality of interdependence (or with the idea of global solidarity), but it is incompatible with the existence of domination. Dependence is the opposite of self-reliance.

Many instances of impoverishment are associated with a loss of self-reliance (either material, cultural, or political) and an increase in dependence on outside (external to the community, social group, or country) resources or decisions. Moreover, many development and poverty-mitigation efforts have resulted in the loss of self-reliance and increased vulnerability. For instance, rural development projects involving a switch from staple to cash-crops often result in temporary increases in income for peasants, obtained at the expense of extreme dependence on international fluctuations in the prices of agricultural commodities, completely outside the possibility of control by the local communities.

The capacity for social organization, and the limits set by the political space available to social actors, especially those not at the top of the power structure, are

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[52] It should also not be assumed that all or most of the effort to eliminate poverty must come from the poor themselves.

[53] Galtung, J. "Self-Reliance: Concepts, Practice and Rationale. In Galtung, J., P. O'Brien and R. Preiswerk (eds.). *Self-Reliance. A Strategy for Development.* Geneva: Institute of Development Studies, 1980, pp. 19–44.

important factors affecting self-reliance. This differs between authoritarian and democratic societies, and is also related to the nature of the vertical linkages between a socio-ecological system and the wider system in which it belongs.

Empowerment

Adaptability, robustness, capacity to respond, and self-reliance are necessary but not sufficient conditions for eradicating poverty and moving towards sustainable development. They are mostly (albeit not exclusively) related to the ability to react to changes and to regulate the influences of other socio-ecological systems on the considered system. In short, they highlight the autonomy of the system, the preservation of its integrity and identity.

Empowerment is the remaining key concept necessary for addressing impoverishment and sustainable development within the proposed systems framework. Empowerment, as conceived of here, implies the capacity of human subsystems not just to *respond* to change, but to innovate and to *induce* change, both within and outside its boundaries, in pursuit of its own goals. It represents the system's capacity to interact with other systems (communities, countries, regions) on more equal terms, and to exert an influence consistent with its objectives. Empowerment requires both self-reliance and the capacity to respond.

As long as the poor are viewed from afar, the myths of poverty and the poor persist. Even those who overemphasize the need for social "safety nets" and handouts, while ostensibly helping the poor, maintain the image of helplessness, and of the need to do something "for" them. A closer view reveals something very different: tremendous work and initiative on the part of the poor, both based on their desire to do something for themselves. This is not a burden, it is an extraordinary social and economic asset. Again, viewed from a distance, poverty looks overwhelming. The closer view reveals very specific situations of opportunities and needs. These can be responded to – not only through soup kitchens, which should be seen as desirable in addressing emergencies only – but through strengthening the individual and collective means available to the poor to carve out their own path of independence and growth. The dynamics of poverty are reversible, but only in collaboration with the poor themselves.

Source: Jazairy, I. *The State of World Rural Poverty: An Introductory Summary*. Rome: International Fund for Agricultural Development (IFAD), 1992, p. 15.

One can conceive of situations or socio-ecological systems in which poverty is perpetuated even though the systems are adaptable, robust, and self-reliant. Examples include the survival strategies developed by the poor within the so-called "informal sector" of some economies, where the social groups involved lack the power to break away from poverty.

As in the case of self-reliance (with which empowerment shares many similarities), the capacity for social organization as well as the characteristics of the wider society are important conditioners of empowerment. Association and collaboration increase the power to control resources and the surrounding environment. However, association among similar social actors can quickly reach a limit in effectiveness; social actors of different levels and interests must be brought together in order to make further progress in increasing the social group's capacity to respond.[54]

Eradicating mass poverty implies that the dominant power relations in society need to be changed. This calls for something beyond an increase in access by the poor to the bases of social power. It calls for transforming social into political power, as well as a politics capable of turning political claims into legitimate entitlements. The struggles of households to gain greater access to bases of social power represent partly a self-reliant effort and partly a political and therefore collective struggle to put forward claims on the state.[55]

Figure 2

Six basic systemic properties underlying sustainability and impoverishment.

EMPOWERMENT

CAPACITY OF RESPONSE

SELF-RELIANCE

ADAPTABILITY/FLEXIBILITY

ROBUSTNESS/RESILIENCE

RESOURCES/ASSETS/ ENTITLEMENTS

If the ultimate goal is the sustainable eradication of poverty through pursuit of a sustainable development path, the key systemic properties presented in Figure 2 including also the basic factors usually considered, such as resources, assets, and entitlements, need to be examined.

Impoverishment in the human subsystem of socio-ecological systems is characterized not only by reduced possibilities for satisfying even basic human needs, but also disempowerment, diminished self-reliance, reduced capacity to respond, reduced adaptability, and increased vulnerability. This often translates into reduced access to (and less effective use of) information, foreclosed options, reduced risk-taking and opportunity-seeking behaviors, breakdowns in existing "safety nets," increased externalization of choice, shifts from anticipatory and routine management to crisis management, increased attention to short-term decisions, and increased rigidity in relations among levels of decision making (individual, family, community, national, and international). These changes, in turn, feed back into and reinforce the impoverishment process. The effects on the interacting ecological subsystem often results in increased fragility of the ecosystem, decreased resilience and productivity, and disruption of ecological life-support functions.

[54] Robirosa, M. "Social Organization and Capacity of Response in Latin American Socio-Environmental Impoverishment Processes." S. C. Bariloche, Argentina: Ecological Systems Analysis Group, 1989 (mimeo).

[55] Friedmann, J. *Empowerment. The Politics of Alternative Development*. Cambridge: Blackwell, 1992.

Systemic Interlinkages

Broadening the boundaries of concern and analysis from economic and social conditions to include human/environmental interactions is necessary to address the crucial interlinkages affecting sustainability and impoverishment. As discussed previously, understanding these linkages – as well as the linkages between the micro and the macro, the local and the global – requires a systems approach.

Linkages are essentially relationships between two or more elements. These relationships may be physical flows of matter or energy (like the paths followed by pollutants as they move from emission sources to the air, and from the air to plants, animals, and humans), or they can be causal influences that are not adequately described as material or energy flows, (e.g., the effect of inequitable land distribution upon impoverishment of the rural population). Socio-ecological systems can be said to have three kinds of linkages:

- Linkages among elements within subsystems (e.g., the linkages within each of the classical sectors in development planning and economic thinking). Often, those are already routinely recognized in decision-making and problem-solving.
- Linkages among elements belonging to different subsystems of the same socio-ecological system, such as the linkages between natural resources and basic human needs, between ecology and economics, between environment and development, between cultural value systems and environmental degradation. Many of these linkages are indirect, involving causal chains with many components; they have been largely overlooked in conventional development thinking.
- Linkages among elements of the considered socio-ecological system (whether local, national, or regional) and elements belonging to other, external socio-ecological systems.

Linkages with external systems can be either with systems having the same hierarchical level of organization (e.g., other countries, or other local communities) or with systems characterized by different levels of organization (e.g., linkages between a local or national socio-ecological system and the global or planetary socio-ecological system).

Linkages with external systems having the same level of organization can be analyzed in two ways. The first approach maintains the focus on a selected socio-ecological system and treats the linkages with the external system (or systems) as inputs and outputs of the system under consideration. In other words, the external socio-ecological system(s) with which the system interacts are viewed as a "black box" such as "the external ecological, socio-economic, and political environment." The inner organization of the external system is not considered.[56] The second approach involves specifying the external socio-ecological system (or systems), and the linkages with the system under consideration. This amounts to defining a new system, including the original socio-ecological system and the formerly external system(s) as subsystems of the new "supersystem."

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[56] Gallopin, G. C. "Environment of a System." In M. G. Singh (ed.) *Systems and Control Encyclopedia*. Oxford: Pergamon Press, 1987, pp. 1486–1489.

Acid rain, the causal relation between rural and urban impoverishment, and international relations of dominance/dependence, all are examples of interactions between systems of the same level. In contrast, global climatic change illustrates linkages with external systems belonging to a different level of organization. In general, such linkages are only recently beginning to be recognized (particularly the ones associated with environmental changes).

Intersectoral (Horizontal) Linkages

Strategies for eradicating poverty and for achieving sustainable development cannot succeed if they do not take into account the existence of mutual and dynamic interactions among social, political, cultural, economic, and ecological factors. These can be referred to as "horizontal" linkages, that is, linkages among elements of roughly the same hierarchy or level of aggregation, either internal or external to the considered socio-ecological system.

The existence of many interlinkages among the elements of a system, particularly complex and multi-causal ones like socio-ecological systems, implies that a change in some component may reverberate through one or more causal chains, triggering changes in other components. This may occur in ways that are not immediately obvious. Often, the indirectly affected components are remote or apparently unrelated to the initially changed elements, or their linkages with the rest of the system may have been overlooked. As a result, changes in the system other than those targeted may appear as a surprise.

This does not mean that all interactions must be identified and understood. In complex socio-ecological systems, perfect knowledge will never be available, and some types of change are likely to be inherently unpredictable. In order to prevent catastrophic failures, it is important to identify and consider at least the most relevant intersectoral causal linkages, as well as to recognize that surprises can arise even in the best studied socio-ecological system. Fortunately, everything is not, in a practical sense, connected with everything else (or at least, usually some linkages are dominant while others can be safely ignored).

Working with interlinked, complex systems (such as those relevant to the environment/development issue), using the linkages to foster sustainability, restoring some important linkages to the system, and even creating some new linkages, is not necessarily more difficult than pursuing sectoral approaches. However, it does require a fundamental shift in mindset, a deliberate attempt to see the system as a whole, composed of inter-related components.

While the need for "holistic," "systemic," or "integrated" approaches in addressing the issues of poverty, impoverishment, and development is often acknowledged rhetorically, this recognition is usually not translated into concrete analysis or actions. More often than not, the traditional sectoral, compartmentalized approach is implemented. Therefore, identifying the major factors and linkages that need to be considered may have conceptual and heuristic value, even if it is done through a rough conceptual model. Even a simplified but holistic overview can be more

useful as a guide to development than highly detailed knowledge that covers only some parts of the problem.

While the roots of the problem of impoverishment, and the means to solve them, are context-specific (and therefore no universal recipes for reorienting impoverishment into sustainable development are likely to exist), some factors and linkages among different kinds of causal factors seem to have special significance and generality.

A number of conceptual models exist to show poverty and environmental linkages; they provide information as well as offer explanations. Figure 3, for example, shows some of the general causal linkages between poverty and environmental degradation. Figure 4 illustrates the problem of the rural poor with limited access to productive lands, and differentiates contributing factors, including environmental stress (comparable to the actions exerted upon the ecological system in Figure 1). Figure 4 also identifies potential adverse ecological consequences (or the ecological effects of Figure 1), and threats to well-being of the poor (equivalent to the translation of ecological effects into human impact in Figure 1). Figure 5 is a causal diagram of environmental problems associated with land use in Latin America and the Caribbean, including the impacts of affluent as well as poor producers.

Figure 6 provides an example of a causal systemic conceptual model applied to the linkages between international trade and impoverishment; it is a first attempt to identify some of the major linkages that contribute to generating impoverishment and environmental degradation in a typical developing country.[57] A case study applying this model to Ghana and South Korea provided useful information on these linkages.[58] Ghana is an example of what the model demonstrates – a developing country whose economy is driven by export crops. In contrast, Korea shows how one country used trade in combination with some exogenous help to achieve rapid economic growth and progress against material impoverishment, albeit with significant restrictions in individual freedoms and human rights.

While they represent different perspectives, these various models are all "negativist" in that they attempt to identify the causal linkages leading to the generation of *problems* (environmental and social). This is, of course, an essential first step in thinking about solutions. However, problems cannot be solved simply by measures designed to modify some of the linkages that generate them. Other linkages may need to be considered or created, and other factors included, lest the solution to one set of problems lead to a new set of more intractable ones.

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[57] Cosbey, A. "Trade and Impoverishment: The Linkages, A View from the South." IISD Draft Document. Winnipeg, Canada: International Institute for Sustainable Development, July 27, 1992.

[58] Loly, C. "Ghana – South Korea Case Studies on the Trade-Impoverishment Linkages." IISD Draft Document. Winnipeg, Canada: International Institute for Sustainable Development, August 1992.

Figure 3

One representation of interlinkages between poverty and environment. Redrawn from "Chart 1: Poverty/environment: the process of cumulative causation". In: Holmberg, J. 1991. "Poverty, environment and development: proposals for action". Paper prepared for the Secretariat of the 1992 United Nations Conference on Environment and Development; International Institute for Environment and Development, London, May 1991.

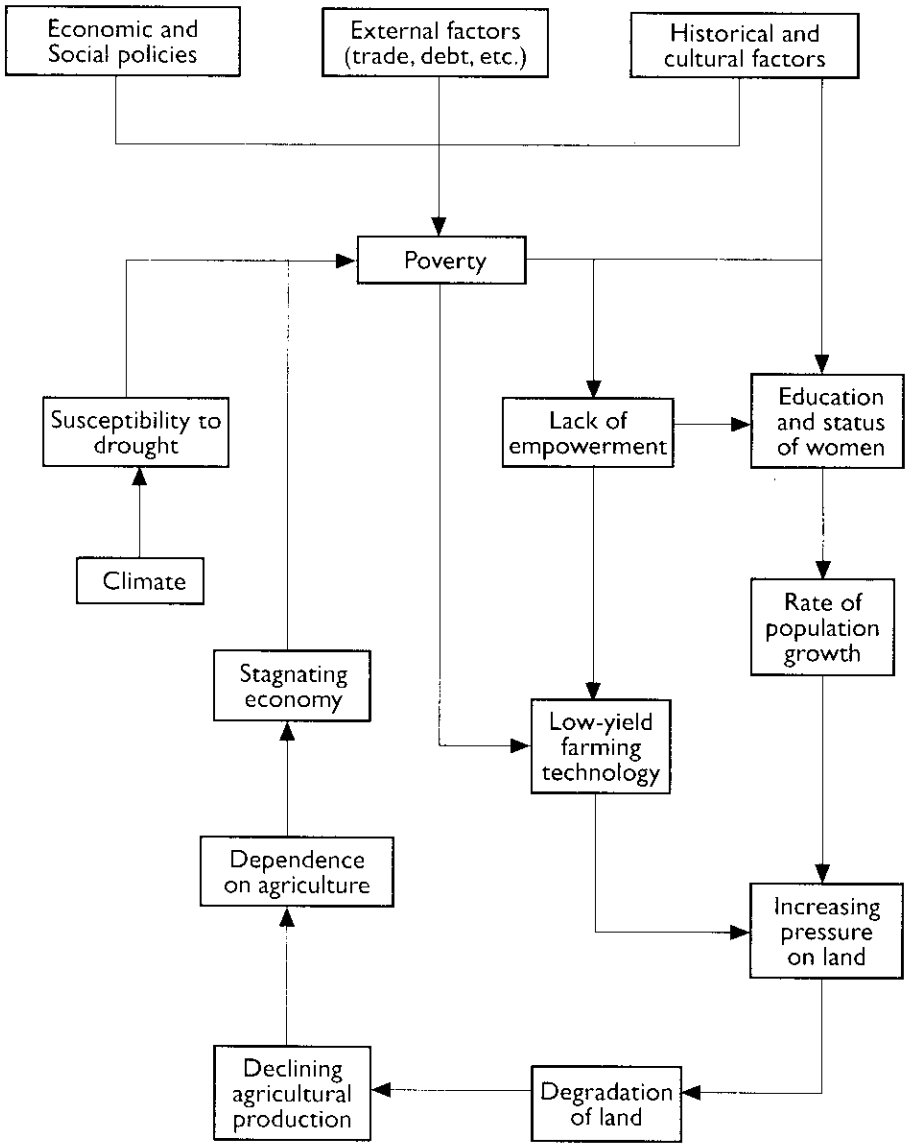
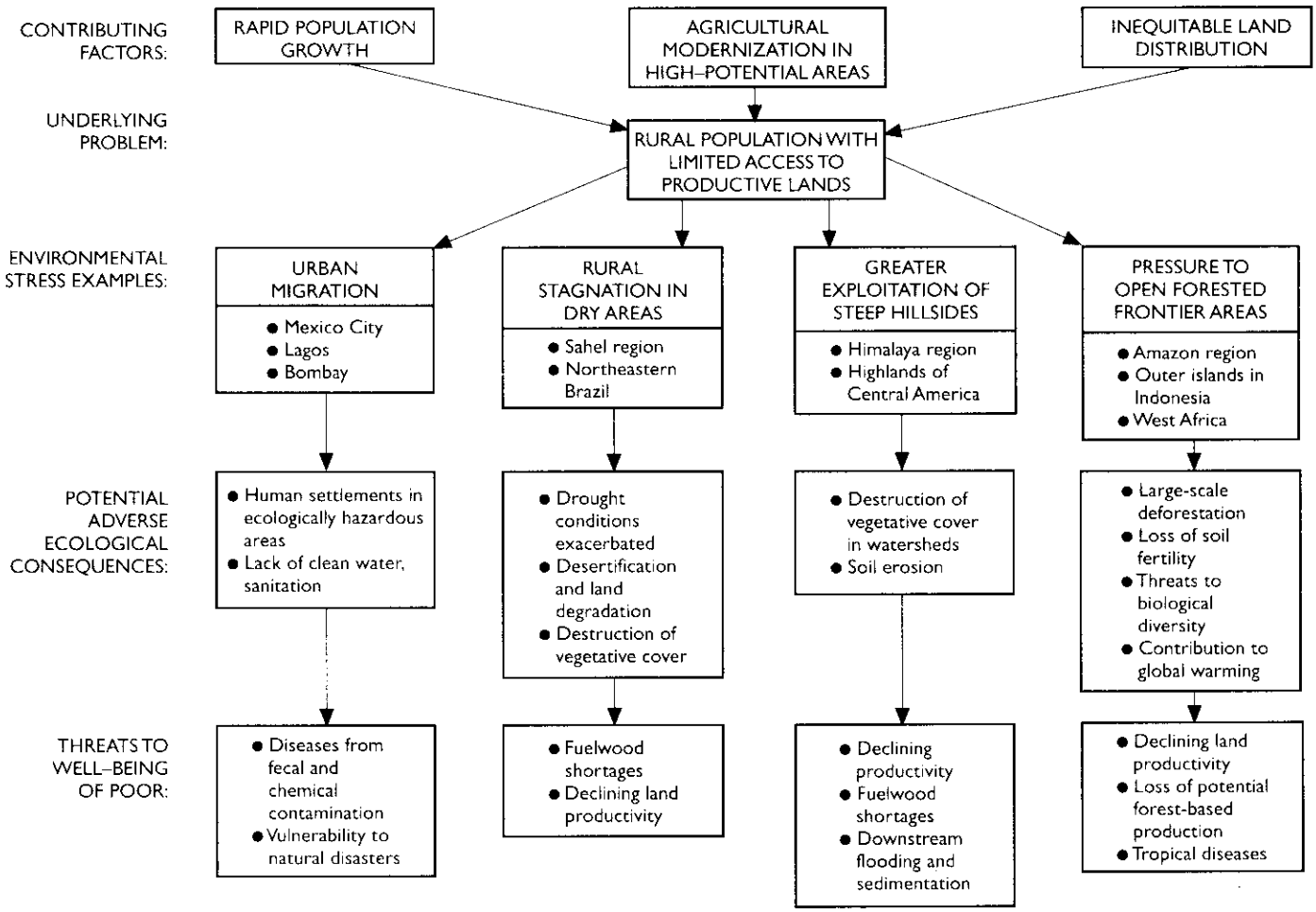


Figure 4

The poverty and environment connection, according to Leonard, H. J. 1989. "Overview"; pp. 3–45 in H. J. Leonard and contributors. 1989. "Environment and the Poor: Development Strategies for a Common Agenda". Overseas Development Council, Washington, D. C.



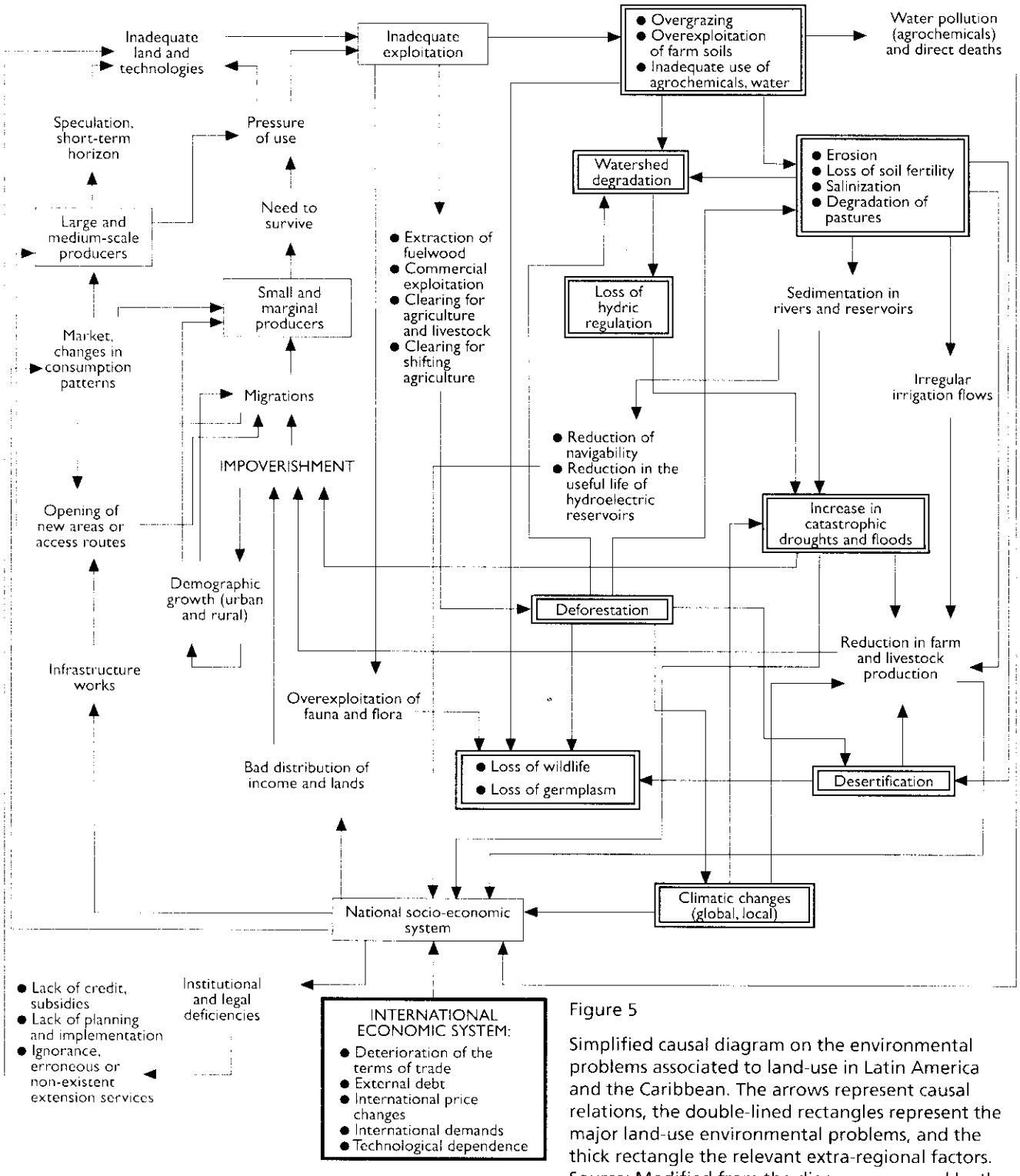


Figure 5

Simplified causal diagram on the environmental problems associated to land-use in Latin America and the Caribbean. The arrows represent causal relations, the double-lined rectangles represent the major land-use environmental problems, and the thick rectangle the relevant extra-regional factors. Source: Modified from the diagram prepared by the Grupo de Analisis de Sistemas Ecologicos; S. C. Bariloche, Argentina, 1989. IDB-UNDP 1990. "Our Own Agenda". Latin America and the Caribbean Commission on Development and Environment. Washington, D. C.

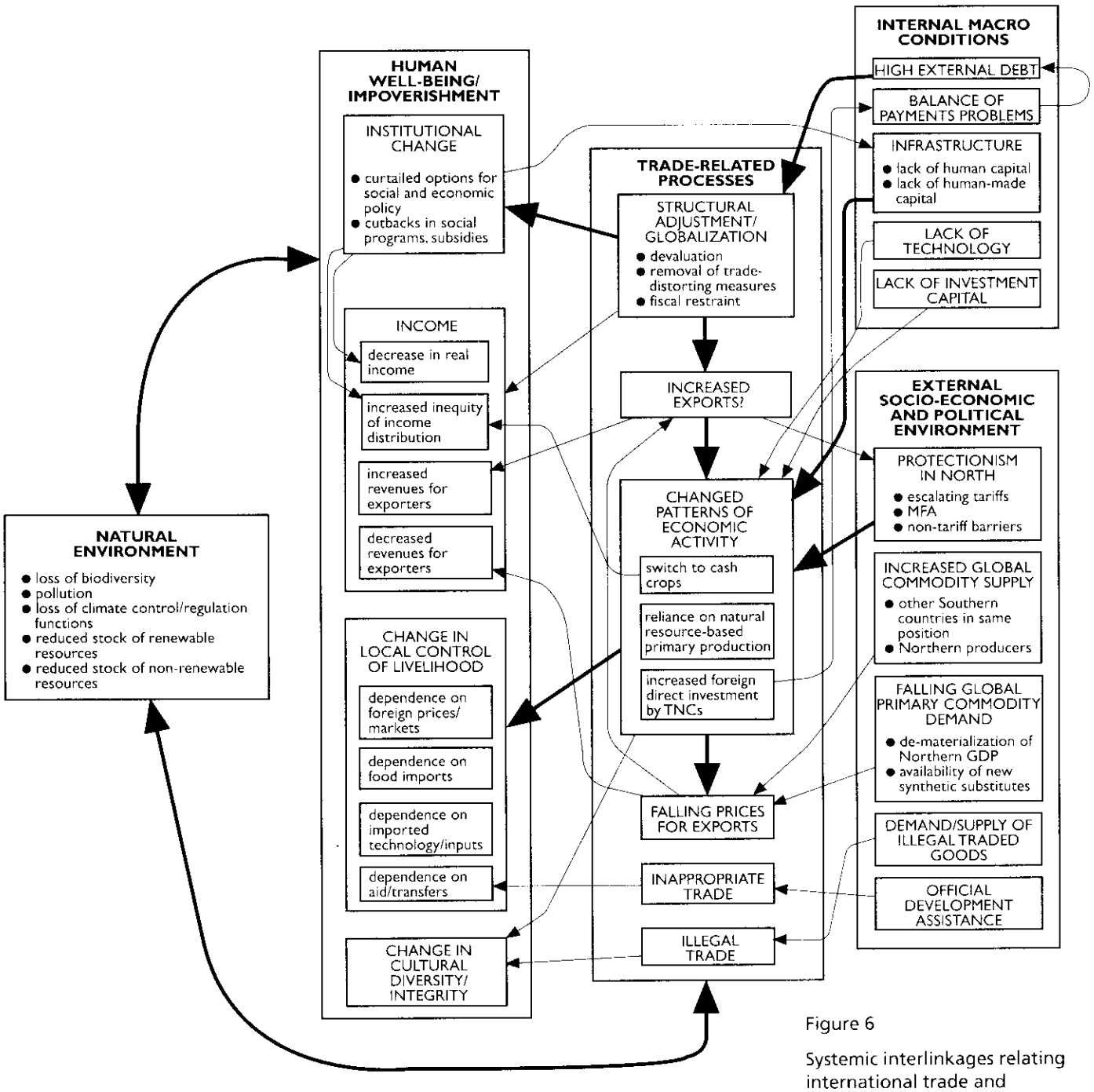


Figure 6

Systemic interlinkages relating international trade and impoverishment. Thick arrows denote the more prominent links. Source: Cosbey, A. 1992. "Trade and impoverishment: the linkages. A view from the South". IISD Draft document, July 27, 1992. International Institute for Sustainable Development, Winnipeg, Canada.

This is why a somewhat different conceptual model that includes the linkages between society and nature has been proposed by the author.[59] It is based on the following criteria:

- Only the factors considered to be most directly relevant to understanding the nexus between society and nature should be included.
- The conceptual model should include the factors and relationships that can potentially explain the problem as well as those that can be used as entry points for solutions.
- The conceptual framework or systemic causal structure should be as *neutral* and as *universal* as possible. *Neutral* implies that the model should be useable to identify the causal chains leading to problems, as well as those that are not problematic and those that can be used to implement alternative solutions. *Universal* means that it should not be tied to a particular type of situation, society, or economic system. It should be capable of highlighting the relationships between society and nature that arise within market as well as non-market economies;[60] the environmental problems associated with poverty as well as those generated by overconsumption; and the socio-economic and environmental specificities and realities of developing as well as of developed countries.
- It should be useable to represent socio-ecological systems at different levels, from the local household and its surrounding environment up to the global or planetary level.

Figure 7 groups the elements of the socio-ecological system into three, broadly defined, major subsystems – the social, the economic, and the ecological. These are spelled out more specifically in Figure 8, which emphasizes the most relevant links among subsystems, rather than the internal structures of the subsystems. Poverty and impoverishment are reflected mainly in the box containing quality of life and, to various degrees, in the other boxes on the right side of the diagram. Ecological sustainability or degradation is referred to in the box labelled "natural environment."

Both production and consumption have two-way linkages with the ecological subsystem. Capital stock (e.g., infrastructure such as roads, dams, etc.) also can affect and be affected by the natural environment. Sometimes the societal subsystem impinges directly on the natural environment without passing through the economic subsystem (e.g., in the case of war, burning of forests as social protest, etc.). And obviously, the natural environment can affect the health and satisfaction of people in other ways than through economic activities.

Figure 9 attempts to identify, at a more operational level, some of the major factors and horizontal linkages particularly relevant for impoverishment and sustainability

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[59] Shaw, R., G. C. Gallopín, P. Weaver and S. Öberg, *Sustainable Development: A Systems Approach*. Final Report to the Secretariat of the United Nations Conference on Environment and Development and to the Department of External Affairs and International Trade of Canada. Laxenburg, Austria: International Institute for Applied Systems Analysis (IIASA), 1991.

[60] Non-market economies include more than centrally-planned economies; they also encompass the peasant, and other non-capitalistic economies, within which millions of people operate.

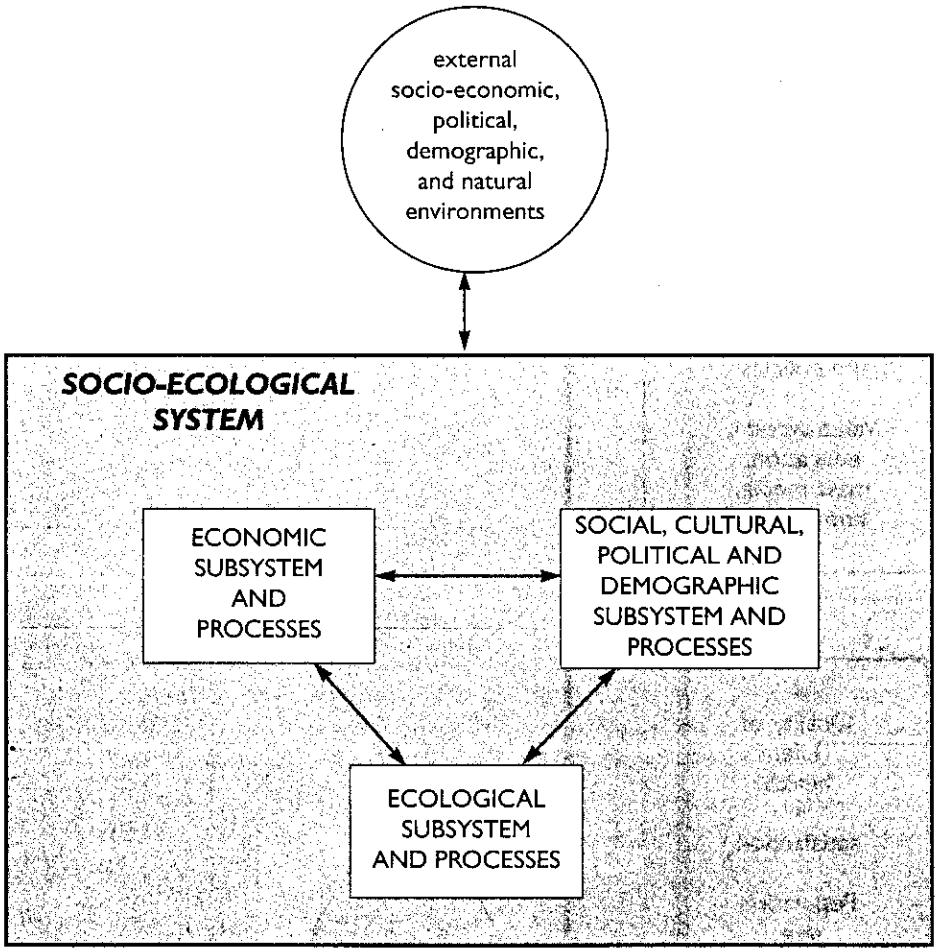


Figure 7

A simplified diagram of a socio-ecological system, indicating the basic subsystems considered in the analysis of impoverishment and sustainability. The large rectangle denotes the considered socio-ecological system, and the circle represents the exogenous factors interacting with the system.

Figure 8 inside gatefold ▶

problems and solutions. Like any conceptual model, it has a degree of arbitrariness. The major point is not whether the conceptual model is "the true one" in any sense, but rather whether it is applicable and useful for concrete as well as for general purposes, and whether it helps to point towards a broader view.

As represented here, the *societal subsystem* includes demographic aspects (size, structure, growth rate, etc.), employment, income, demand, consumption, and social organization (meaning the social, political, legal and cultural situation and structure, including of course power relationships). Together, total population size, per capita demand, and social organization can be considered to determine the total demand for goods and services.

Consumption is defined broadly as including not only the consumption of commercial products, but also the direct consumption of natural goods and services by the population, such as the physiological consumption of oxygen for breathing, or the direct non-commercial consumption of firewood.

Quality of life is viewed as the ultimate goal of development, as an indicator of the degree of achievement of human development, and as the central criterion that helps to characterize the human environment. The level and variation of quality of life among the members of a given society determines the societal requirements that must be fulfilled in order to satisfy the needs and desires of its members, and contributes to determining the society's pattern or strategy of development.

The *economic subsystem* is considered to impinge upon the ecological subsystem mainly through the production process, mediated by the technology that is used. The volume of production is the major indicator of the relationship between the economic and the ecological subsystems. The larger the production processes, the more demands are exerted upon the natural environment in terms of both input and output. However, for any given volume and structure of production or consumption, alternative technologies could generate different (either negative or positive) impacts on the ecological subsystem.

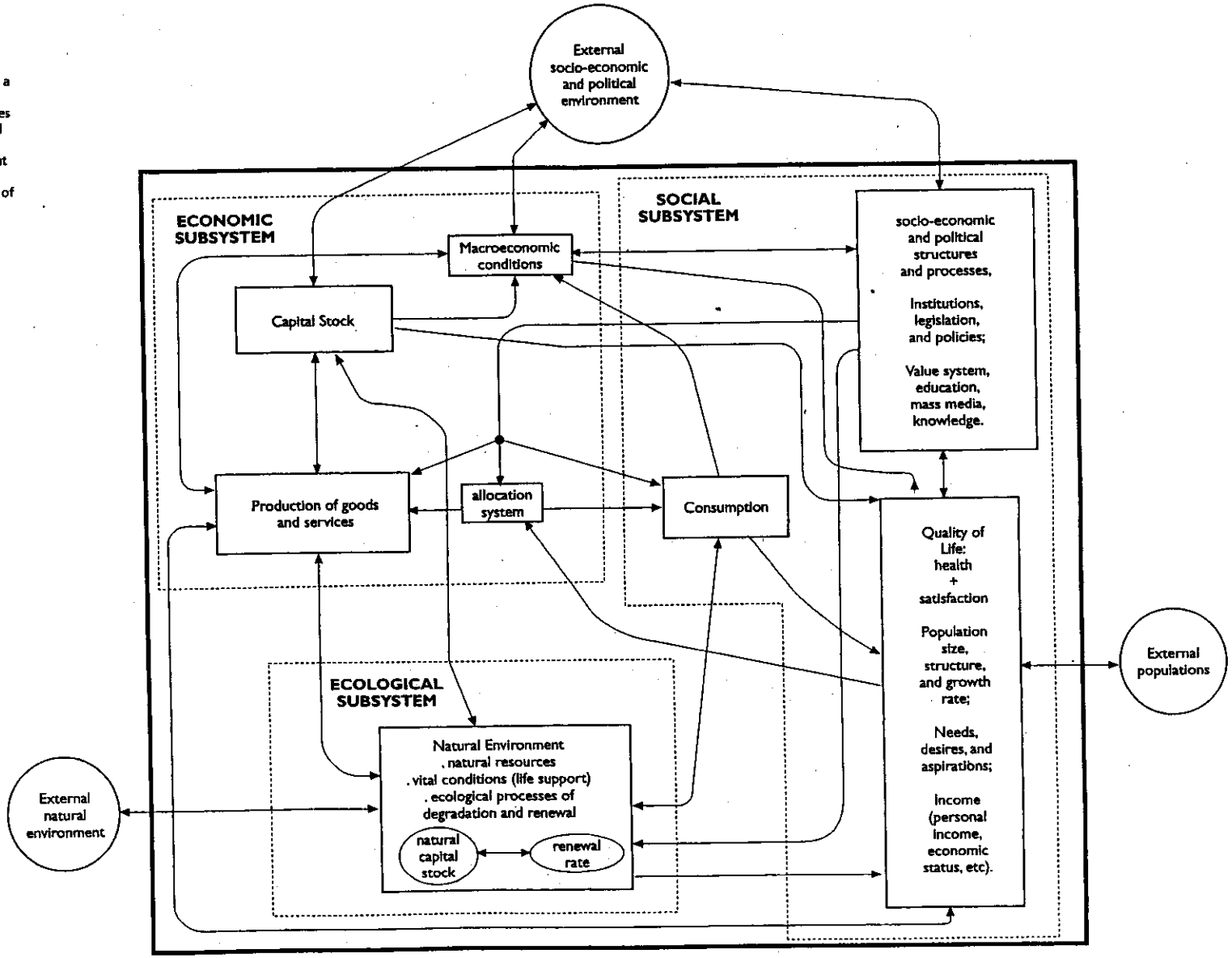
The *built environment* (i.e., constructed by people) includes the urban environment, infrastructure, etc.; it represents part of the accumulated capital stock generated by investments. It sometimes impacts the ecological subsystem (e.g., through encroachment of natural or agricultural lands by urbanization); however, it is included in the conceptual model primarily because its quality, together with the quality of the natural environment, directly affects the health and satisfaction – and therefore the quality of life – of people.

The *natural environment* or *ecological subsystem* provides natural resources (both renewable and non-renewable) for development, such ecological functions as waste assimilation capacity, and life-support functions affecting habitability (climatic and hydrological regulation, etc.). This subsystem includes not only virgin and unaltered nature but other ecological systems as well. Thus managed ecological systems (e.g., agricultural lands or managed forests) are included within this subsystem.

Two particularly relevant attributes of the ecological subsystem are the renewal rates of its components and its robustness or vulnerability. The former determines

Figure 8

A more detailed, but still highly simplified, conceptual diagram of a generalized socio-ecological system, indicating the interlinkages between the social, economic and ecological factors most relevant for the analysis of impoverishment and sustainability. The thick lined rectangle indicates the boundary of the considered socio-ecological system; the dashed lines indicate the boundaries of the basic subsystems, and the circles represent the exogenous factors.



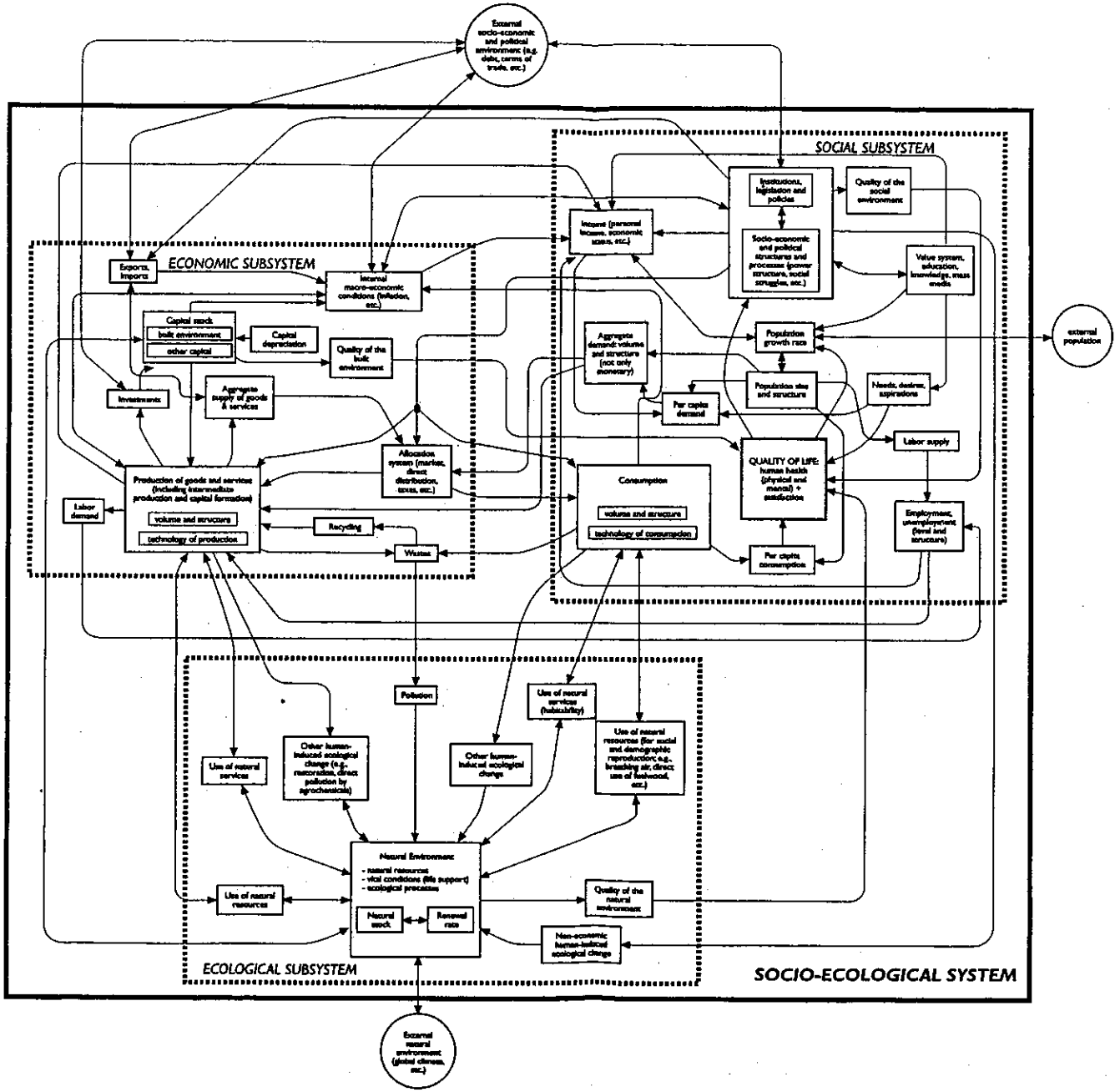


Figure 9

Basic general conceptual model of the major elements and linkages in socio-ecological systems. Source: modified from Shaw, R., G. C. Gallopín, P. Weaver and S. Öberg. 1981. "Sustainable Development: A Systems Approach". Final Report to the Secretariat of the United Nations Conference on Environment and Development and to the Department of External Affairs and International Trade of Canada. International Institute for Applied Systems Analysis (IIASA): Luxemburg, Austria.

◀ Figure 9 inside gatefold

the rate at which natural "goods and services" can be provided or replaced and the latter determines whether the subsystem can continue to provide those goods and services or whether it will suffer severe behavioral or structural ecosystemic changes. Both these attributes can be affected by human activities.

At all levels, exports and imports of economic and non-economic items (materials, energy, or information) are potentially significant in economic and ecologic terms (e.g., exporting pollution, externalizing environmental costs).

In this model, three elements are external to the socio-ecological system: the external natural environment, the external population, and the external socio-economic and political environment. In the case of the global socio-ecological system, the most meaningful external natural environmental component is solar energy.

Even in this relatively simplified model, it is obvious that there are many ways in which poverty and environmental quality are related. The eradication of poverty through sustainable development must take into account, at the very least, these factors and linkages. Most current policies addressing poverty do not deal explicitly even with this minimum set, making them unlikely to be successful in eradicating poverty in a sustainable manner.

The variables in Figure 9 that characterize poverty or affluence for a given population or community are quality of life (resulting from psycho-somatic health and the subjective feeling of satisfaction), per capita consumption, income, per capita demand, as well as needs, desires, and aspirations. One could also use the model to analyze poor and affluent production and/or consumption systems.

Consider, for example, the environmental degradation associated with rural poverty. It results mostly from inappropriate land use by rural producers (who in many cases are the major consumers of their own production). Often, the poor are outside the "modern economy"; they have low per capita incomes and low per capita consumption, with negative implications for both their health and their levels of satisfaction. They lack access to the means of production (including inputs, technology, and ownership or entitlement of the land), and they are forced to overexploit the environment (and themselves) merely to survive. This can lead to deforestation, soil erosion, desertification, depletion of coastal fisheries, etc. (depending on the system of production and the ecosystem). The wastes and pollution generated by the rural poor are to a large degree organic wastes derived from physiological consumption and pathogenic organisms and vectors associated with their precarious health.

Their total effective ("paying") demand is basically proportional to their numbers (because per capita effective demand is at its minimum).

Some of the characteristics associated with low income (high infant mortality, lack of security for old age, lack of education, need for family labor, etc.) are also often associated with high population growth rates, which in some cases aggravates the situation further. Political and social factors are also critical. The human development index (HDI) developed by the UNDP shows that, even within the

group of economically poor countries, there can be considerable differences in some of the relevant indicators of quality of life; these differences are associated with the socio-economic structure, the power structure, and the type and priorities of the societal allocation system.

These critical links between poverty and environmental degradation can be traced and highlighted in the conceptual model shown in Figure 8 in order to a) examine the appropriate points of entry in particular situations, and b) identify which disciplines and perspectives needs to be combined in order to find solutions.

At the other extreme, environmental degradation associated with affluence has quite different causes, including inadequate land use resulting from myopic profit-making without consideration of the long-term, land speculation, inadequate use of megatechnologies, and overconsumption. Non-organic and toxic wastes resulting from both consumption and production are widespread. Per capita effective demand is high and usually growing, dissociate from the numbers of rich, and is more directly associated with wants than with human needs. When consumerism becomes a value or a social status symbol (often fostered by advertising and propaganda), per capita demand for material goods can spiral up indefinitely, gobbling large amounts of natural resources and services. The population growth rate in affluent groups and societies is generally low (but every additional affluent person consumes many times the amount of energy and material resources consumed by a poor person).

Eliminating environmental degradation associated with affluence and overconsumption requires addressing a number of interlinked factors. The prevailing value system must be transformed; alternative, environmentally more benign, satisfiers of human needs must be promoted; cleaner technologies must be developed and diffused; per capita material consumption must be regulated socially; and legal and institutional mechanisms must be implemented and enforced.

Interlevel (Vertical) Linkages

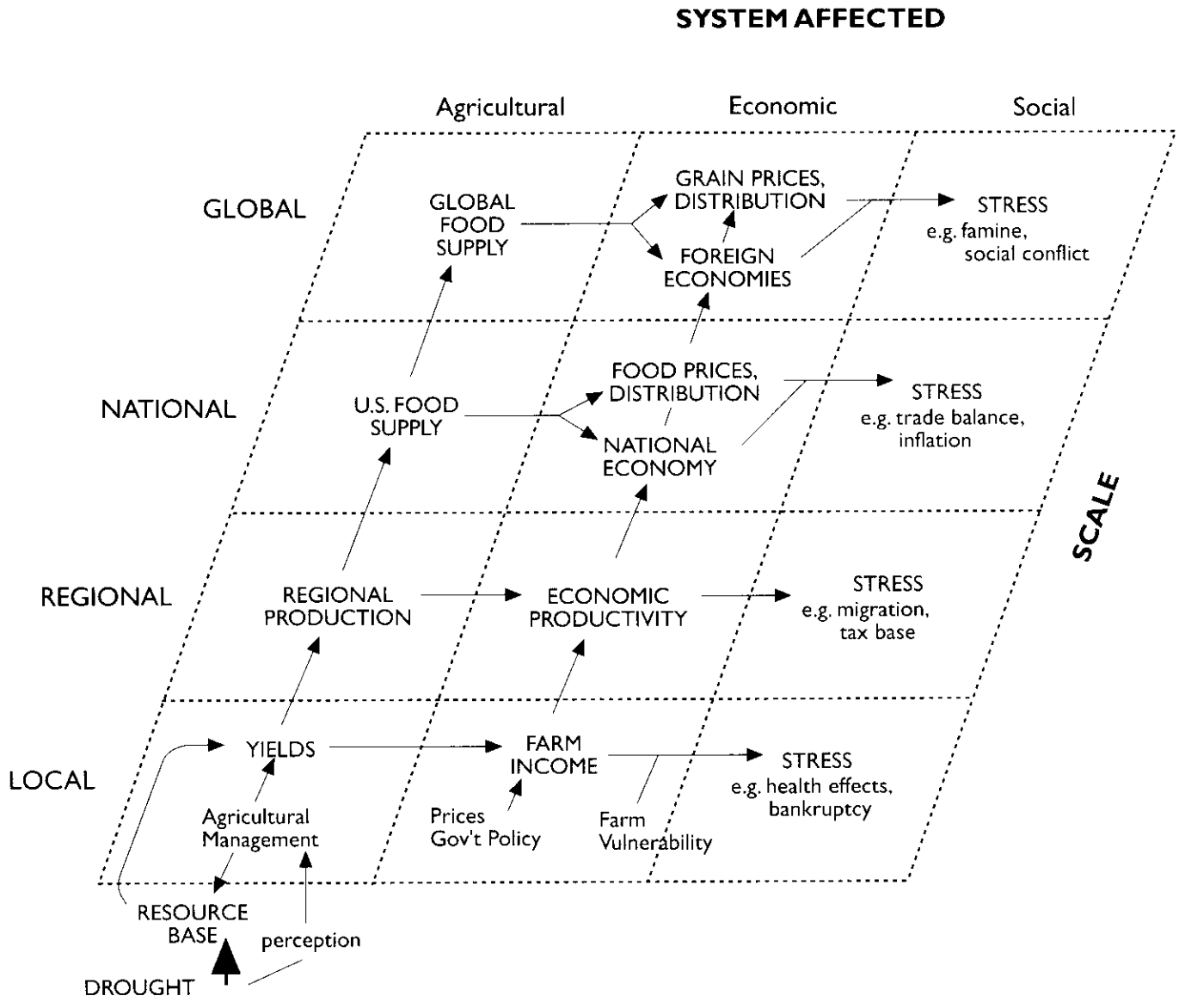
Interlevel or vertical linkages represent the interactions between socio-ecological systems belonging to different levels of organization (e.g., local, national, regional, global). Figure 10 shows a hypothetical set of pathways and linkages of impacts that could result from drought in the Great Plains, including horizontal level stresses as well as vertical stresses. Prior to the 1930s, the impacts from drought were horizontal or local; today there is concern that a major drought would have not only local but national or global (that is, vertical) impacts.[61]

The global socio-ecological system can be interpreted as a hierarchical system, composed of regional, national, subnational, and local socio-ecological systems. This hierarchy of levels is not arbitrary, since established institutional relations are

[61] Timmerman, P. *Vulnerability, Resilience and the Collapse of Society.* Environmental Monograph No. 1 (EM-1). Toronto: Institute for Environmental Studies, University of Toronto, 1981.

Figure 10

Pathways of Drought Impact. Source: redrawn from Warrick, R. A. and M. J. Bowden. 1980. "Changing impacts of drought in the Great Plains, perspectives and prospects". Univ. Nebraska Press, Lincoln, Nebraska.



visible at each of the levels. The United Nations system, and some transnational corporations, are institutional systems of global reach; there are many regional institutions, such as regional development banks, the regional economic commissions of the United Nations, and regional military and economic alliances; national governments operate essentially at the country level; and municipalities and other institutional arrangements act at the local level.

Linkages between the global and local socio-ecological systems are bi-directional. The global socio-ecological system influences the local system mainly via effects on the local society (e.g., changes in international prices and demand, changes in the international economy and power relations, etc.) and on ecological systems (e.g., increased climatic variability, unexpected floods, fires and droughts, etc.). These global changes could be viewed, from the standpoint of local systems, as input/output exchanges with the outside environment that influence the internal structure and functioning of the local system, and therefore as potential sources of stress and structural change (in the context of dissipative self-organizing systems).[62]

The most obvious (but not the only) influence of local socio-ecological systems upon the global socio-ecological system is through cumulative effects. The planetary ecological basis for sustainability and development is being increasingly eroded through the combined effect of many local actions. Changes in global processes such as atmospheric circulation and bio-geo-chemical cycles are intensifying. These changes induced by man's industrial and agricultural activities are reaching the level at which natural regulatory processes of the global atmosphere operate. Thus ecological responses to local human actions are affecting the global system, which in turn triggers unexpected impacts on local regions.

Local (that is, sub-national or national) actions can result in a variety of global (that is, planetary or international) impacts; these may include biophysical impacts, as well as social effects with environmental implications. Similarly, global biophysical and international socio-economic changes can have a number of important global and local impacts.[63]

In the concrete case of Andean peasant agriculture, a number of causal chains can be identified. They include causal factors and impacts at different levels of aggregation (worldwide, national, sectoral and micro-economic), and in different institutional settings (international relations, national or local governments, intersectoral relations, micro-regional economic systems, and the farm itself). The most relevant include:

- Factors operating at the global level:
  - Protectionism in the world agricultural market
  - Development of substitutes for developing-country produce

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[62] Nicolis, G. and I. Prigogine. *Self-Organization in Non-Equilibrium Systems: From Dissipative Structures to Order Through Fluctuation*. New York: Wiley, 1977.

[63] Gallopín, G. C. "Human Dimensions of Global Change: Linking the Global and the Local Processes." *International Social Sciences Journal* 130 (1991), pp. 708–718.

- External debt crisis (reduced availability of foreign loans for development purposes, increased pressure in favor of austerity policies in debtor countries)
- Pressure of foreign capital on the natural resources of developing countries.

▸ Factors operating at the national level:

- Urban-bias in food price policies
- Disregard of environmental factors in policymaking
- Capital-intensive bias in agricultural research
- Limited availability of credit for peasant farmers

▸ Factors operating at the local (micro) level:

- Reduced demand for peasant-marketable products
- Disregard of environmentally safe technologies by technical officers
- Land encroachment by big enterprises
- Pressure on peasants to overexploit the environment to meet minimum basic needs
- Scarcity of roads and transportation for agricultural and peasant-marketable products [64]

These factors create different impacts for different parts of the socio-economic system. At the *farm* level, they result in soil erosion both for small peasant farms and for large agricultural enterprises; neglect of conservation infrastructure; genetic deterioration of peasant seeds and animal breeds; and malnutrition, poverty, and reduced access to education. These factors also make environmentally safe production unfeasible.

At the *local* or *micro-regional* level, these factors can result in salinisation, desertification, deforestation, soil depletion, reduced rainfall, reduced water retention, emigration, and an increasingly dilapidated service infrastructure. Potential impacts at the *national* level include reduced food availability, excess migration to cities, increases in the informal economy, increased food imports, and decreased food self-reliance, pressure on aid sources, and inability to meet foreign debt.

Peasant farm production today is sensitive to distant factors that operate through elaborate channels. An increase in the "prime rate" of U.S. banks may trigger policy changes throughout the developing world (insofar as external debt service costs are linked to world-level interest rates) that directly affect the lives of small subsistence producers, and in turn cause environmental damage or hinder resource conservation.

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[64] Maletta, H. *Macroeconomic Constraints on Soil Conservation in Andean Peasant Agriculture.* Report to the Ecological Systems Analysis Group. S. C. Bariloche, Argentina. 1988.

Persistent peasant poverty, gradually eroded environments for their small-scale production systems, and disregard of conservation techniques may be the distant echo of international and national factors linked to such processes as the debt crisis, capital flight, multinational enterprises, structural and monetary adjustment policies, urban unrest around wage and price settlements, and other not-too-obvious macro-economic issues. In this way, the ruling international system of economic relations may not only be keeping poor nations poorer, but also accelerating the rate at which the earth is being destroyed. The mountains and forests of South America are a remarkable case in point.

The analysis of impoverishment and sustainable development therefore must take into account the multi-level nature of the problem: changes in local socio-ecological systems contribute to global ecological changes, and also to international political and economic changes; and changes in global socio-ecological systems generate opportunities or constraints for the sustainability and development of local socio-ecological systems. This analysis cannot follow the usual approach of averaging the lower level (i.e., local) phenomena in order to account for their effects upon the higher level (i.e., global) phenomena, while assuming that global changes are so slow relative to the local level that they can be taken as constants in terms of their effects on the local level.

When there is a strong dynamic interaction between different hierarchical levels in a system, complex and counter-intuitive behavior may appear. In these situations, strong non-linear couplings between subsystems of different levels, or between slow and fast variables, may dominate the dynamics of the whole system. In general, this is more likely to happen when the time and space scales of the involved phenomena are similar.

For instance, it has been argued that, other things being equal, social and ecological processes occurring at a much smaller and faster, or much larger and slower, pace than global climatic change are unlikely to interact with it as strongly as those of comparable scale. The characteristic time scale of the forecasted climatic warming is similar to that of demographic transformations in agricultural societies, the market shares of various nations' principal industrial commodities, and the relative shares of total energy demand met by particular fuels. Therefore, over the same time interval at which human-induced climatic change is expected to unfold, there is likely to be significant urbanization and market integration of developing countries, geographic shifts in the world's economic and political power, and changes in the form and source of the global energy base. Strong interactions among these phenomena and global climatic change can be expected in principle.[65]

At first glance, these considerations might appear to have little relation to the linkages between the local and the global, as the scales involved are very different. But this is not necessarily so. Firstly, the aggregate spatial scale of millions of local actions (agricultural developments, deforestation, industrial developments, etc.) is approaching the scale at which larger processes operate. Secondly, some large-scale, even global, processes, may be reducing their time scales, thus approaching

[65] Clark, W. C. "Scales of Climate Impacts." *Climatic Change* 7 (1985), pp. 5–27.

the characteristic time scales of faster, lower-level, processes. Due to the combination of the increasing speed and scale of changes, the operation of a planetary network of telecommunications, and the global reach of many decision-making systems, the assumption that dynamic time scales at the global level are slower than at the local level may not be valid for a number of cases. The consequences of this are unpredictable.

Even when the scale differences between local and global are preserved, strong interactions across levels may occur. They result from non-linearities and are known to exist in a variety of chemical, climatological, marine, and ecological systems.[66]

Complex systems may also exhibit different kinds of "chaotic" behaviors, including increases in small and rapid fluctuations through turbulent non-linear processes that alter long-term, large-size patterns of system behavior, thereby creating large impacts from small-scale events.[67] Even simple climatic systems can exhibit this kind of behavior.[68] Thus, explicit and careful attention should be paid to the relevant time and space scales in considering the interactions between the local and the global. Every case-study of impoverishment in socio-ecological systems should attempt to distinguish which possible cross-scale and interlevel influences are important and which can be safely ignored.

Understanding local/global interactions in socio-ecological systems requires consideration of the following questions in each case:

- *What are the relevant vertical links or interactions?* Identifying the most relevant links between the local and the global level for a particular local socio-ecological system, or a set of such systems, should not be too difficult (although quantification might prove impossible).
- *What are the significant temporal and spatial scales of the relevant local and global processes? How are they related?* If the scales of the local and global relevant processes are very different, it is reasonable to assume that local socio-ecological systems and processes will tend to react to the slower, higher-level processes as if they were constant constraints. Often, those slow changes will not be perceived locally. However, they may trigger strong structural reorganizations (including the crashing) of the local systems. Conversely, the global processes can be expected to react only to the cumulative, or the average, condition of the local processes. These situations can be handled in a rather straightforward way.

If the scales are similar, or becoming convergent, complex cross-level interactions should be expected. Those situations should be scrutinized much more carefully. Preliminary analysis of the kind proposed for climate impact studies can prove useful as an initial guide for identifying those situations.[69]

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[66] Clark, W. C. "Scales of Climate Impacts." *Climatic Change* 7 (1985), pp. 5–27; Nicolis, G. and I. Prigogine. *Self-Organization in Non-Equilibrium Systems: From Dissipative Structures to Order Through Fluctuation.* New York: Wiley, 1977.

[67] Gleick, J. Chaos. *Making a New Science.* New York: Penguin Books, 1988.

[68] Lorenz, E. N. "The Problem of Deducing the Climate from the Governing Equations." *Tellus* 16 (1964), pp. 1–11.

[69] Clark, W. C. "Scales of Climate Impacts." *Climatic Change* 7 (1985), pp. 5–27.

- *What is the pattern and direction of change at different levels?* Are the processes operating at different levels and scales conflicting with each other, mutually reinforcing, or diverging?
- *In which way do global processes impinge upon the local situation, and local changes affect the global level?.* This question focuses on the causal analysis of the hierarchical system, identifying specific mechanisms and considering the possibility of strong non-linearities and dynamic interactions between levels in order to anticipate changes.

Understanding the links between local and global socio-ecological systems is not an easy task. Not only are complex systems interlinked across levels, but there is also a permanent co-evolution of microscopic and macroscopic processes, that mutually set the conditions for each other's evolution.[70] Microscopic systems are not just subsystems of macroscopic systems, and the latter are not just the environment of the former. Rather, they can be viewed as complementary and interplaying aspects of a continuous process of evolution of the universe, a process arising from the self-organization properties of non-equilibrium dissipative systems.

In summary, poverty eradication and sustainable development must be tackled simultaneously at various levels from the local to the global. The various linkages at different levels and their implications must be examined. This means that local programs should be responsive to both the constraints and opportunities offered by national and international environments, and that global programs must be assessed in terms of their effects on the current and future situation of local poor populations in different parts of the world.

This is not an abstract consideration. Grass-roots movements around the world have demonstrated their capacity for innovation and have shown that effective efforts to eradicate poverty begin by putting the poor in control. Yet local and national efforts could be ineffective without fundamental changes at the international level.[71]

Within the national level, vertical interlinkages are also important. It is often felt that the poor are somehow "outside" the scope of national economic policies. This is virtually never the case. They are affected by national economic policies, generally by being exposed to the costs, and excluded from the benefits.[72]

The attempts of the poor to free themselves of misery take place within constraints that limit how much leverage the community has. Often these constraints can only be removed, attenuated, or circumvented through the creativity of the poor communities. It matters vitally therefore to any impoverished, marginalized, or oppressed group to know how tolerant the macro social control system within which it lives can be of drastic changes. This differs between democratic,

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[70] Jantsch, E. *The Self-Organizing Universe. Scientific and Human Implications of the Emerging Paradigm of Evolution.* Oxford: Pergamon Press, 1980.

[71] Durning, A. "Life on the Brink." *World-Watch* (March-April 1990).

[72] Jazairy, I. *The State of World Rural Poverty. An Introductory Summary.* Rome: International Fund for Agricultural Development (IFAD), 1992, p. 16.

authoritarian, and totalitarian governments. As put by Goulet, the leverage space for liberation is largely a function of how many *interstices of deviance* exist within any national society. This is why it is always necessary, when speaking about sustainable development alternatives and poverty eradication, to indicate at what level of society leverage to undertake the alternative can be found.[73]

There must be complementarity between grass-roots local initiatives and macro-policies, between "bottom-up" and "top-down" strategies of development.[74]

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[73] Goulet, D. "Development as Liberation: Policy Lessons from Case Studies." *World Development* 7 (1979), pp. 555–566.

[74] Uphoff, N. "Assisted Self-Reliance: Working With, Rather than For, the Poor." In J. P. Lewis et al. *Strengthening the Poor: What Have We Learned?* Oxford: Transaction Books, 1988, pp. 47–59; and Paul, S. "Governments and Grassroots Organizations: From Co-Existence to Collaboration." In J. P. Lewis et al. *Strengthening the Poor: What Have We Learned?* Oxford: Transaction Books, 1988, pp. 61–71.

Policy Implications of Using Systems Analysis in Fighting Impoverishment

A number of questions and implications arise naturally from the systemic focus proposed in this volume. Some of these policy implications may not be readily apparent when using traditional sectoral perspectives.

The following list is presented only as examples, without any pretense of completeness. Concrete research activities will surely generate additional examples.

- The proposed systems approach offers a rational alternative to the search for long lists of indicators of sustainability, and to taxonomic descriptive approaches, by pointing to the importance of identifying and monitoring a few truly systemic indicators. This means that if systems are to be evaluated in terms of sustainability, the emphasis must move from indicators of systems outputs to indicators of systems properties *per se*; figures on current GNP say nothing about the state of the system generating the GNP.

  To take a simple example, the catch from a fishery can increase year after year at the same time that the fish stocks are being depleted. The value of the catch may increase, along with the value of the capital equipment represented by the fishing fleet and the fish processing plant. If concern is only for immediate return on investment, the state of the fishery is irrelevant. The relevant indicator is profit. If, however, the concern is for sustainability, relevant indicators would be the state of the fish stocks, the number of people dependent on the fishery for a livelihood or for sustenance, the vulnerability of the fishery to overfishing or ocean pollution, and the capacity of those involved to adapt to the fishery's potential exhaustion.[75]

- The systems approach emphasizes the need to consider the causal structure of the system, and to explore the possibility of more effective, systemic policies, based on gentle efforts or small investments in different critical nodes along a causal circuit. It demonstrates the need for coordination between multiple actors, disciplines, institutions, and jurisdictions. It also illustrates why the sectoral problem-solving approach often fails when it invests or concentrates efforts massively in a single sector, factor, or link. Such efforts may dissipate along many other causal chains or may backlash, reverberating from unintended changes.

- The systems approach shows the need for multi-level (vertical) co-ordination. Some problems of socio-ecological impoverishment cannot be solved solely at the local, or the national, or the global level. It highlights the need for new institutions, or new institutional mechanisms, capable of coordinating or cooperating simultaneously at different levels. It sheds new light on the question of governance, as well as on the question of what decisions must be returned back to the local level, and what decisions should belong to the global level.

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[75] Shaw, R., G. C. Gallopin, P. Weaver and S. Öberg. *Sustainable Development: A Systems Approach*. Final Report to the Secretariat of the United Nations Conference on Environment and Development and to the Department of External Affairs and International Trade of Canada. Laxenburg, Austria: International Institute for Applied Systems Analysis (IIASA), 1991.

- It emphasizes the complementarity between top-down and bottom-up approaches to development. Both local strategies and macro-policies are required to eradicate poverty. Due to social and ecological specificities, strategies for transforming impoverishment into sustainable development will have to be context-specific; however, replicability of activities or at least of the strategic principles on which they are based is essential if poverty eradication is to be extended to all the poor. The role of macro-policies (national or international) cannot be neglected. They can either destroy local efforts, or enable, amplify, and spread them.
- It highlights the need for policies that do not try to over-determine the system (thereby freezing, or even crashing it), but that aim at increasing its generalized capability to cope with, and to benefit from, change (even new and unexpected change).
- The systems approach also shows that, because of increasing systemic connectedness and interdependence, the causes of modern impoverishment may be far from the local situation. Therefore, policies for eradicating poverty and promoting sustainable development should also look outward and be responsive to changes outside the local or national system. The issues of responsibility and accountability are thus broadened.

Agenda 21 from a Systems Perspective

The conceptual model represented in Figure 8 can also serve the purpose of indicating which of the major elements of the considered socio-ecological system are or are not targeted by specific activities or actions. It can be used as a guide for action.

Agenda 21, the set of action proposals adopted by the international community at the United Nations Conference on the Environment and Development, outlines specific steps needed, from the local to the global, in 115 environment and development areas. Chapter 3 of the document addresses the issue of poverty in the context of sustainable development, with the long-term objective of enabling all people to achieve sustainable livelihoods.[76] This section will discuss the Agenda 21 poverty proposals in the context of the systemic perspective presented in this volume; specifically, it will translate the actions proposed in Chapter 3 of Agenda 21 into the language of the systems approach diagrammed in Figure 9.

Agenda 21 recognizes that "Poverty is a complex multidimensional problem with origins in both the national and international domains," and that "An effective strategy for tackling the problems of poverty, development, and environment simultaneously should begin by focusing on resources, production and people..." This corresponds roughly to the three major subsystems (ecological, economic, and social) included in the conceptual model used here. The document defines a number of activities under the headings of a) empowering communities, b) management-related activities, c) data, information and evaluation, and d) international and regional cooperation and coordination.

Because governments were the participants in the meeting, the proposals are mostly directed to governments, with a final set referring to international organizations. The basic socio-ecological system level of reference can be taken, therefore, to be the country, even when a number of proposals target special groups.

In the discussion below, the proposed activities are stated exactly as in Agenda 21, although they are presented here according to generic similarities rather than in their original order. They are referred to, as in Agenda 21, by the letter of the major heading (a) to (d) above, followed by the letter associated with the specific activity under the heading (except in the case of (c) which does not contain subheadings).

Agenda 21 contains the following recommendations:

(b-i) "Implement mechanisms for popular participation – particularly by poor people, especially women – in local community groups, to promote sustainable development" and *(a-d) "Give communities a large measure of participation in the sustainable management and protection of the local natural resources in order to enhance their productive capacity."* Both activities are very similar, with the difference that (a-d) specifies the themes of natural resources and productive capacity. In terms of the conceptual model diagrammed in Figure 8, these recommendations translate into: act upon "institutions, legislation, and policies"

[76] United Nations Conference on Environment and Development (UNCED). "Agenda 21, Chapter 3: Combating Poverty." Final Advanced Version adopted by the Plenary in Rio de Janeiro, July 9, 1992. Geneva: UNCED, 1992.

(i.e., implement mechanisms) to influence the political processes and power structure through popular participation to promote sustainable development. The phrasing leaves the impression of aiming at a narrowly defined arena of participation.

(b-b) "With international support, where necessary, develop adequate infrastructure, marketing systems, technology systems, credit systems and the like and the human resources needed to support the above actions and to achieve a widening of options for resource-poor people. High priority should be given to basic education and professional training." In terms of the systems approach in Figure 8, this can be said to mean: act upon the production activities (investments in infrastructure, improvements in technology, educational services) and upon the allocation system.

(a-e) "Establish...a network of community-based learning centers for capacity-building and sustainable development." That is, act upon institutions (networks of centers) and upon the production of services (education and capacity-building). It can be viewed as a particular case of (b-b).

(b-j) "Implement, as a matter of urgency, in accordance with country-specific conditions and legal systems, measures to ensure that women and men have the same right to decide freely and responsibly on the number and spacing of their children and have access to the information, education and means, as appropriate, to enable them to exercise this right in keeping with their freedom, dignity and personally held values, taking into account ethical and cultural considerations. Governments should take active steps to implement programs to establish and strengthen preventive and curative health facilities, which include women-centered, women-managed, safe and effective reproductive health care and affordable, accessible services, as appropriate, for the responsible planning of family size, in keeping with freedom, dignity and personally held values, taking into account ethical and cultural considerations. Programs should focus on providing comprehensive health care, including pre-natal care, education and information on health and responsible parenthood and should provide the opportunity for all women to breast-feed fully, at least during the first four months post-partum. Programs should fully support women's productive and reproductive roles and well-being, with special attention to the need for providing equal and improved health care for all children and the need to reduce the risk of maternal and child mortality and sickness." In terms of the systems model, this proposal translates into: 1) promoting knowledge and education in order to foster people's right to family planning thus affecting (presumably reducing) population growth; 2) acting upon "institutions, legislation, and policies" to ensure gender equality of rights regarding family planning (thus influencing the circuit "quality of the social environment", "quality of life", "population growth rate"); and 3) establishing and strengthening health facilities (including reproductive health care) and services for family planning. That is, increase the supply of services (health and family planning), increase total and per capita consumption or use of those services, improve health and maternal and child mortality and morbidity, reduce incentives leading to high population growth. Because these services must be "accessible and affordable," changes in existing allocation rules will be required in many cases.

(b-e) "Set up an effective primary health care and maternal health care system accessible to all." Similarly to (b-j), this proposal implies acting on the production of (health) services, as well as on the allocation rules.

(b-p) "Provide the poor with access to freshwater and sanitation" and *(b-q) "Provide the poor with access to primary education."* Both are similar to (b-e).

(b-f) "Consider strengthening/developing legal frameworks for land management, access to land resources and land ownership – in particular, for women – and for the protection of tenants." That is, act upon legislation to improve the rules of allocation, use, and ownership of land and housing.

(b-h) "Establish new community-based mechanisms and strengthen existing mechanisms to enable communities to gain sustained access to resources needed by the poor to overcome their poverty." This is a broad generalization of (b-f) but too undefined to permit mapping onto the conceptual model, except as affecting institutions, legislation, and/or policies.

(b-o) "Consider making available lines of credit and other facilities for the informal sector and improved access to land for the landless poor so that they can acquire the means of production and reliable access to natural resources. In many instances special considerations for women are required. Strict feasibility appraisals are needed for borrowers to avoid debt crises." Very similar to (b-h) and (b-f), but focusing upon loans for gaining access to the means of production (including natural resources).

(a-a) "Empower...women through full participation in decision-making." Acts upon "institutions, legislation, and policies."

(a-b) "Respect...the cultural integrity and the rights of indigenous people and their communities." Act upon "institutions, legislation, and policies" to affect the societal value system and the quality of the social environment of indigenous people.

(a-c) "Promote or establish...grassroots mechanisms to allow for the sharing of experience and knowledge between communities." That is, act upon (grass-roots) institutional mechanisms enabling knowledge and experience sharing.

(b-a) "Generate remunerative employment and productive occupational opportunities compatible with country-specific factor endowments, on a scale sufficient to take care of prospective increases in the labor force and to cover backlogs." That is, act upon the circuit: Production activities, increase labor demand, increase employment.

(b-c) "Provide substantial increases in economically efficient resource productivity and measures to ensure that the local population benefits in adequate measure from resource use." This can be translated to mean: 1) improve technology of production to make resource use economically more efficient (this could affect the "use of natural resources" if "resources" in the recommendation means natural resources). As the recommendation refers to "economically efficient" resource productivity, this could result in lowered labor demand and lower or higher wastes; and 2) act upon the rules for allocating economic supply to consumption; and (conceivably)

to investment through the circuit: investment, capital stock, quality of the built environment, quality of life of the local population.

(b-d) "Empower community organizations and people to enable them to achieve sustainable livelihoods." This general statement is somewhat ambiguous in terms of the systems model, but could involve acting upon "socio-economic and political structures and processes," particularly upon the power structure, as well as acting upon "institutions, legislation, and policies." This could in turn affect many linkages, depending on the particular actions and the current situation.

(b-g) "Rehabilitate degraded resources, to the extent practicable, and introduce policy measures to promote sustainable use of resources for basic human needs." That is, 1) generate "other human-induced ecological change" (in this case, rehabilitation of degraded resources) and 2) act upon "institutions, legislation, and policies" to change the structure of consumption towards coverage of basic needs and towards sustainability (presumably by acting via the allocation rules on production and consumption and their use of natural resources).

(b-k) "Adopt integrated policies aiming at sustainability in the management of urban centers." In other words, act upon "institutions, legislation, and policies" to influence the management of the built (urban) environment.

(b-l) "Undertake activities aimed at the promotion of food security and, where appropriate, food self-sufficiency within the context of sustainable agriculture." This involves acting on the (food) production system and its technology and (possibly) on food imports to ensure supply of food (this wording does not guarantee access to food by the poor).

(b-m) "Support research on and integration of traditional methods of production that have been shown to be environmentally sustainable." That is, act upon the production system (research is part of the service sector) to find ways of integrating sustainable traditional technologies of production.

(b-n) "Actively seek to recognize and integrate informal sector activities into the economy by removing regulations and hindrances that discriminate against activities in those sectors." Or, act on "institutions, legislation, and policies" to remove legal impediments.

(c) "Data, information, and evaluation: Governments should improve the collection of information on target groups and target areas in order to facilitate the design of focused programs and activities, consistent with the target-group needs and aspirations. Evaluation of such programs should be gender-specific, since women are a particularly disadvantaged group." This means acting upon production activities (collection of information) to improve the governmental base of knowledge.

(d) "The United Nations system, through its relevant organs, organizations and bodies, in cooperation with Member States and with appropriate international and non-governmental organizations, should make poverty alleviation a major priority and should: (d-a) Assist Governments, when requested, in the formulation and implementation of national action programs on poverty alleviation and sustainable development. Action-oriented activities of relevance to the above objectives, such as

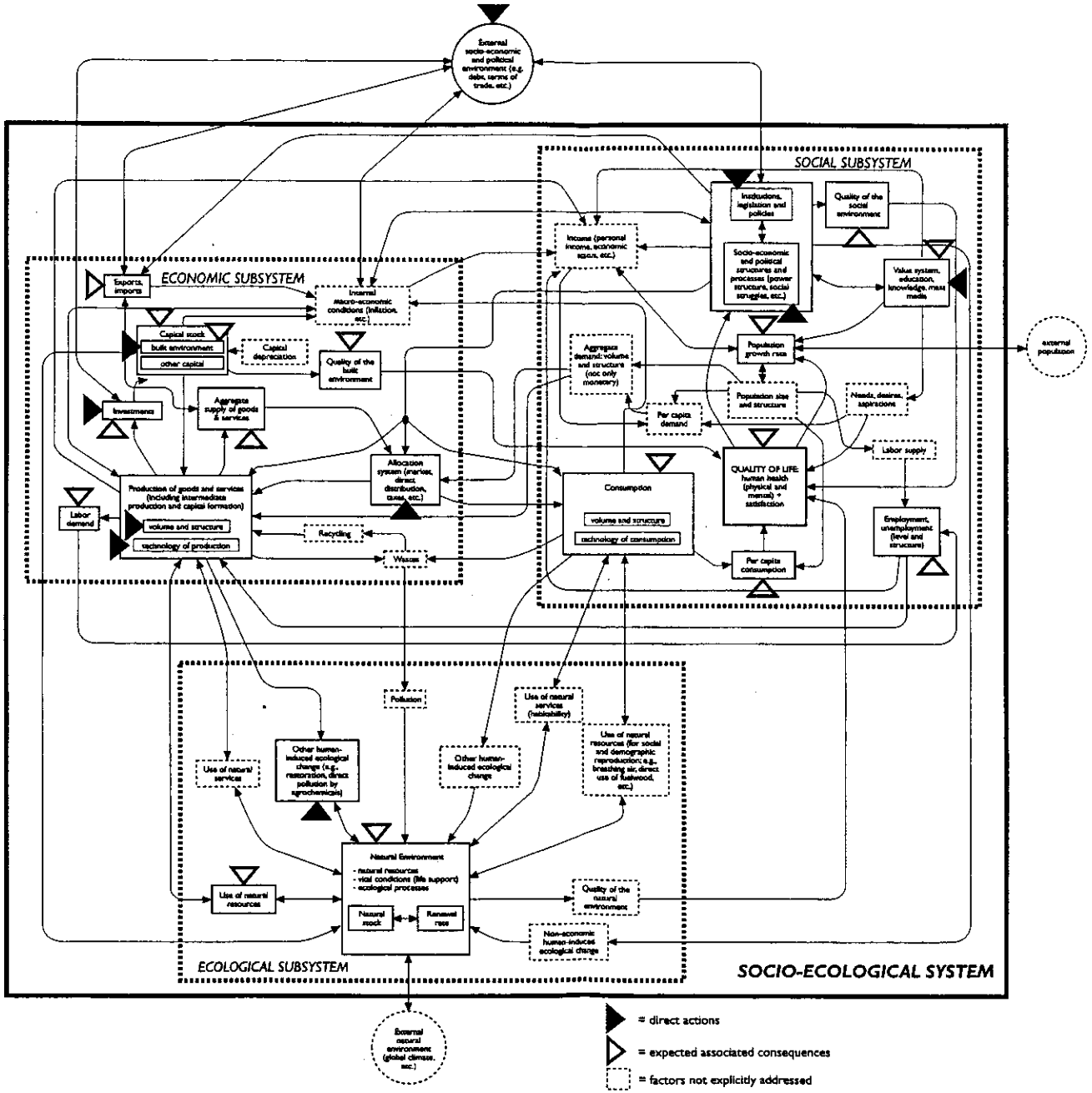

Figure 11

A mapping of the actions proposed in Chapter 3: "Combatting Poverty" of Agenda 21, into the general conceptual model. Solid triangles indicate direct actions; open triangles indicate where associated consequences of the actions could be expected, and the shaded boxes indicate factors not explicitly addressed.

◀ Figure 11 inside gatefold

poverty eradication, projects and programs supplemented where relevant by food aid, and support and special emphasis on employment and income generation, should be given particular attention in this regard; (d-b) Promote technical cooperation among developing countries for poverty eradication activities; (d-c) Strengthen existing structures in the United Nations system for coordination of action relating to poverty eradication, including the establishment of a focal point for information exchange and the formulation and implementation of replicable pilot projects to combat poverty; (d-d) In the follow-up of the implementation of Agenda 21, give high priority to the review of the progress made in eradicating poverty; (d-e) Examine the international economic framework, including resource flows and structural adjustment programs, to ensure that social and environmental concerns are addressed, and in this connection, conduct a review of the policies of international organizations, bodies and agencies, including financial institutions, to ensure the continued provision of basic services to the poor and needy; (d-f) Promote international cooperation to address the root causes of poverty. The development process will not gather momentum if developing countries are weighted down by external indebtedness, if development finance is inadequate, if barriers restrict access to markets, and if commodity prices and the terms of trade in developing countries remain depressed." All of these actions refer to the "external socio-economic and political environment" (external to the socio-ecological system defined at the aggregation level of a country).

Figure 11 maps the actions proposed in Agenda 21 on the systems model, showing clearly that a substantial number of important linkages are not specifically addressed. Even when recognizing that Chapter 3 proposals could be misinterpreted here, and that Agenda 21 contains 40 chapters (i.e., that many other factors are addressed elsewhere in the document, although not necessarily in the context of poverty eradication), the dispersion and fragmentation of the proposed activities is significant. Besides, as indicated in the discussion of activity "(b-c)," some of the proposed actions may collide among themselves.

The pattern of concentration of actions is also interesting: as interpreted here, the largest number of proposed actions fall in the areas of institutions, legislation, and policies (11 proposed actions) and the volume and structure of production (12); six proposals were interpreted as acting directly on the allocation rules; six on the external socio-economic and political environment; five on the technology of production; two on value system, education, knowledge, mass media factors; two on investments; and one each on socio-economic and political structures and processes, exports/imports, and other human-induced ecological change.

Also interesting is the fact that most of the proposed actions affecting the volume and structure of production refer to services: education (3), research and information gathering (2), health services (2), freshwater and sanitation services (1). Other proposals affecting production involve investments in infrastructure (2), increasing food production (1), and increasing production in general (1).

New Research Areas

A number of strategic research areas can be identified from the systems perspective developed in this book. Within each of these, specific hypotheses can be postulated and tested. These are key areas for developing an improved understanding of how processes of impoverishment can be reversed or avoided, and transformed into sustainable development paths.

Causes and Impacts of Modern Poverty

An important research area involves determining what the root causes of modern poverty are. The central issue involves identifying the major causes and mechanisms driving impoverishment processes in socio-ecological systems. The systems perspective adopted here suggests that there is no single root cause of impoverishment, but rather an interlinked set of causal mechanisms, continually unfolding and impacting different socio-ecological systems in different ways. The impacts vary, depending on the previous history of the system and its present condition. For instance, the integration of peasant agriculture into the modern economy has resulted in the loss of self-reliance and clear impoverishment in many cases, but in other situations it has led to sustained amelioration of living conditions. Rapid population growth may be the cause of social and ecological impoverishment in some cases, but in many others it is just an aggravating factor, and in still others, it is not even a contributing factor.

A related issue is whether there is a common set of root causes or causal mechanisms producing poverty, or whether the causes must be separated into meaningful clusters affecting different social systems, ecological situations, and levels of affluence in different ways. For instance, does impoverishment in the South and the North have a common causal basis? If not, what are the basic distinctions? Is impoverishment a necessary consequence of the current pattern of development? What are the most relevant links between social impoverishment and environmental degradation?

Because the answers to these questions can be significantly influenced by the cultural and ideological perspective adopted, it is important to explore them through a cooperative international and intercultural research network, using numerous approaches (including empirical case studies, comparative analyses, historical and theoretical perspectives, etc.).

Identification of Systemic Attributes of Sustainability

The second set of key research questions centers on identifying and characterizing the most important systemic attributes, properties, or processes that must be understood and included in the design of policies and strategies to eradicate poverty through sustainable development. These may be conditions such as vulnerability or self-reliance, or they may represent underlying factors impinging

on these attributes. Sometimes, certain modes of organization of socio-ecological systems, or the structure and strength of horizontal or vertical linkages, may be the crucial factors.

A number of important questions should be addressed. These include determining what factors contribute to systemic vulnerability or robustness, whether and when it is possible to guide structural change towards "anastrophic" (rapid and beneficial) directions, what kind of indicators may be used to anticipate nearness to critical stability thresholds, what the relative importance of internal and external fluctuations is in fostering structural change in socio-ecological systems, how to distinguish between dynamic and structural changes, to what degree these are predictable, and so forth.

Sustainable development implies persistence but also change; eradicating poverty by switching to sustainable development implies drastic changes. A basic set of research questions involves addressing what needs to change and what needs to be sustained. In other words, what are the foundations and reserves of human knowledge, experience, cultural cohesion, as well as ecological renewal and homeostatic capacity that must be protected, nurtured, or created, and which accumulated rigidities and impediments must be removed? Which are the lost linkages to be restored, and which are the new linkages that need to be created? Which kinds of investments, policies, trade patterns, etc., increase vulnerability, and which kind foster robustness? Which systemic conditions could create abrupt structural change leading towards either impoverishment or sustainability?

The development of operational indicators of crucial systemic properties would have direct application for policy and decision making. This area includes the search for integrated whole-system indicators of conditions and dynamics that could be monitored and used as criteria for assessing sustainable development and poverty eradication efforts, as well as for anticipating future conditions.

Closely related is the question of sustainability indicators for the poor. Two kinds of efforts would be useful. The first consists of developing indicators tailored to improve the measurement of poverty and of how different dimensions of poverty interact (e.g., how reducing poverty in one of its dimensions may affect the others, at different scales).[77] The second involves developing ways of incorporating into poverty eradication efforts the sustainability indicators that the poor themselves use to assess their situation and to reduce their vulnerability; this is an area ideally suited for participatory research.

A final research issue in this area is the question of which systemic attributes can serve as appropriate entry points for actions directed to help move the whole socio-ecological system onto a sustainable path.

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[77] I am indebted to Dr. Atiq Rahman for suggesting this first aspect.

Impacts of Mega-processes on Impoverishment

A third set of research questions refers to the analysis of selected human or natural "mega-processes" that can have major future impacts on impoverishment, changing the whole context within which solutions are sought.

The world is in a period of rapid and fundamental change that will almost certainly result not in continuation of past trends, but in genuinely new situations. Some trends – like the increasing economic power and global reach of large transnational corporations and the weakening of nation states – are following a collision course. This is likely to result in crises and transformations. Similarly, other human or natural mega-processes such as climatic change, population growth, or increasing inequality, are likely to have profound impacts on impoverishment. Identifying and characterizing global socio-economic, cultural, or ecological trends affecting impoverishment and sustainability, and their potential impacts, is an important research issue. The research should also seek to identify potential future breaking points in current trends and possible windows of opportunity.

Appropriate Methodological Tools

A set of methodological questions also needs to be addressed. For instance, methodologies need to be developed and tested to trace and anticipate the impacts of macro-factors such as trade, corporate behavior, institutions, and national budgets, on impoverishment. "Poverty impact assessment" methodologies could help evaluate the systematic effect of human activities and determine how these need to change to help the transition to sustainable development.

Another methodological priority relates to articulating the "bottom-up" and "top-down" approaches to development and poverty eradication. Within the perspective of this book, this refers to combining both a systems approach that creates an understanding of change dynamics and the grassroots approach of changing by doing. Finding ways of translating the visions and experiences of grassroots movements into one or more shared systemic frameworks applicable to many situations, or of using a systemic approach to identify key points for grassroots action, could have important strategic value.

Strategies and Institutional Mechanisms

The fifth critical research area involves identifying appropriate strategies and institutional mechanisms by drawing on the research results from the other areas above defined. The relevant research questions here are: What is the feasibility of eradicating poverty in a sustainable manner by the early twenty-first century? What measures and what resources will be needed under various alternative scenarios (such as business as usual, or scenarios including fundamental technological changes, structural changes in the patterns of consumption, in corporate behavior, etc.). What kind of new systemic strategies and institutional mechanisms are

required? What are the major stumbling blocks and what are the potential windows of opportunity? What must be done? What would be the likely social, economic, and ecological consequences of not implementing the required actions?

Conclusion

As noted at the outset, poverty eradication can be viewed as an end in itself, as a necessary condition for sustainable development, or as a means of moving towards sustainable development.

Most people agree that poverty is an unnecessary evil that must be eliminated. In other words, eradication of poverty is clearly justified as an end in itself. Moreover, there are many indications that the complete eradication of poverty is today economically and technically feasible. However, there is a fundamental difference between defining the goal as "eradicating poverty" and defining it as "eradicating poverty through sustainable development."

Many current approaches to poverty alleviation, if implemented, would add large numbers of people to the consumer society, promote the values embodied in the currently prevailing lifestyles of the relatively well-off, and pursue technological improvements allowing increases in productivity and possibly a decrease in per unit (not necessarily in total) pollution. These approaches do not address the consumption patterns of the affluent sectors of society, except indirectly in those proposals that contain strategies for redistributing income through taxes or other mechanisms.

Most discussions of poverty alleviation do not question that this "developed-country scenario" is a desirable goal; criticism of the lifestyle of the rich as unsustainable is reserved for the environmental literature, in which poverty eradication is often viewed as a component of sustainable development, with the solution discussed in terms of lowering population growth rates.

The "developed-country scenario" is a desirable goal from a humanitarian point of view, and it is certainly better than the current situation in which abject poverty coexists with opulence. However, since it is increasingly clear that the patterns of consumption currently pursued by affluent societies and affluent groups within the poor societies are unsustainable and not replicable for large numbers of people, this scenario will prove to be either an impossible mirage or an unstable situation that will result in a huge catastrophe after a transient period of apparent prosperity.

For this reason, strategies for eradicating poverty must include changes in the values and lifestyles of the whole society or attempts to eradicate poverty will carry the seeds of their own failure. Even integrated and innovative approaches such as that proposed by the International Fund for Agriculture and Development (IFAD), in which the rural poor are perceived as actors in development rather than as objects for welfare, fail to address the broader issue of the changes needed in the whole society to ensure long-term eradication of poverty.[78]

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[78] Jazairy, I.; M. Alamgir and T. Panuccio. *The State of World Rural Poverty: An Inquiry into its Causes and Consequences*. New York: IFAD/New York University Press, 1992.

One of the major obstacles to overcome in fighting poverty is the perception of poverty itself – and of the poor. In this regard, perhaps the most important point is that the poor are not idle, they *work*. Nobody is simply "poor." In other words, it is not just a state of being. In this regard, "poor" is more aptly used as an adjective rather than as a noun. The rural poor are poor farmers, poor herders, and poor fishermen. In short, they are poor *producers*: their incomes are gained from their work. The answer to poverty lies in creating the conditions for them to earn *more* from their work. From this perspective, overcoming poverty does not mean less growth, it is a contributor to growth – for it means making the poor more productive. Too often in the past, poverty alleviation has been seen as a burden on the economy, as involving a transfer of something for nothing in exchange. It need not be that way: it can be an investment in production, benefitting both the poor and the national economy. *This* has been the essence of IFAD's approach. **Poverty has been defined as a production problem, and poverty alleviation as an investment.**

Source: Jazairy, I. "The State of World Rural Poverty: An Introductory Summary." Rome: International Fund for Agricultural Development (IFAD), 1992, p. 14.

This book provides no final answer to the question of how to eradicate poverty through sustainable development. However, it is a well-known epistemological principle that how the problem is posed strongly influences the repertoire of solutions to be considered. It is my hope that the questions that follow from the approach used here will help generate new kinds of solutions.

An important issue is the relative roles of political action and of methodological and research issues (on which this book concentrates) in the eradication of poverty. It could be argued that political will, and political activism, should be enough to eradicate poverty without the need for further research (except for a better identification of who and where the poor are, and specification of which policy instruments to apply). Since much is known about what needs to be done, political will is in fact the most important missing ingredient. But ending poverty *through sustainable development* will require new and integrative approaches, making research an urgent priority.

More than identification and measurement, the required research should focus on increasing understanding of the complex socio-ecological systems within which poverty must be eradicated. Understanding without political will cannot eliminate poverty; but political will without understanding could lead to illusory solutions. Poverty eradication efforts should move in parallel with research efforts and practical actions to change societies towards more sustainable paths. Eradication or even reductions in poverty cannot wait until sustainable development is obtained, or until knowledge and understanding are complete. One of the things that can be done immediately is to look at problems from a different perspective and to pose different questions. This has been one of the purposes of this book.

Another priority issue is identifying the key systemic properties of socio-ecologic systems that must be understood in order to move toward the sustainable eradication of poverty. Only a first sketchy attempt has been presented here. Research will be needed to develop this approach further; additional systemic properties should probably be considered, although I believe the ones included (adaptability, robustness, capacity to respond, self-reliance, and empowerment) are basic. These are all concepts that have been used in other contexts, but within a systems framework, and as a coherent set, they gain additional meaning – as guidelines for causal explanations and as criteria for identifying systemic indicators of impoverishment or sustainability.

Since poverty has generally been seen as a given condition or state, not much attention has been paid to the dynamic processes associated with impoverishment. Identifying and studying impoverishment processes is another critical research and policy need. A tentative set of impoverishment processes has been proposed, but not fully developed, in this volume.

IFAD has also proposed a set of socio-economic processes that generate and perpetuate rural poverty, which it considers fairly universal.[79] These include domestic policy-induced processes, dualism, population growth, resource management and the environment, natural cycles and processes, the marginalization of women, cultural and ethnic factors, exploitative intermediation, internal political fragmentation and civil strife, and international processes. In the IFAD approach, each kind of process generates different types of rural poverty. While this list seems to mix processes (in the sense of causally interlaced phenomena unfolding in time) with factors or constraints, this kind of analysis is valuable and sorely needed.

Further analysis is needed to determine which are the most relevant impoverishment processes (in developed as well as developing countries), and to develop a typology of processes.

A major underlying theme in this book has been the need to integrate – to use a relational and holistic approach to poverty eradication and sustainable development. Compartmentalized and specialized thinking has generated tremendous advances in knowledge and splendid technological breakthroughs. But when applied to complex interrelated problems (such as development, the environment, and poverty), it has often also aggravated the total problem by trying to solve parts of it.

Prevailing approaches to development are demonstrating serious inadequacies. Indeed, in a number of cases, the very success of classical compartmentalized approaches has lead to worsening the environmental and developmental problems addressed. Even the language and metaphors we use may be hindering discussions

[79] Jazairy, I.; M. Alamgir and T. Panuccio. *The State of World Rural Poverty: An Inquiry into its Causes and Consequences*. New York: IFAD/New York University Press, 1992.

about sustainable development.[80] Of more immediate concern, the present historical context and dynamics exhibit major differences with that of the past few decades.

The quest for eradication of poverty through sustainable development, and the quest for sustainable development itself, requires integrating economic, social, cultural, political, and ecological factors. It requires combining top-down approaches to development with bottom-up or grassroots initiatives. It requires the simultaneous consideration of the local and the global dimensions and of the way they interact. And it requires broadening the space and time horizons to accommodate the need for intergenerational as well as intragenerational equity.

Rapidly increasing interdependence and the need to foster a sense of common purpose among different social actors (government, business, labor unions, NGOs, community organizations, political parties, minority groups, etc.) make it necessary to move beyond traditional disciplinary thinking if sustainable development is to be reached. Not only must the approach be interdisciplinary, it must also be interparadigmatic, intercultural, interinstitutional, and interjurisdictional. Dialogues must take place between scientists and non-scientists, between the modern and the traditional, between the North and the South. What is required is constructive communication and cooperation among people having diverse mindsets, visions, and objectives.

Throughout this book, a flexible systems analysis approach has been advocated. Nevertheless systems analysis as it is known (and particularly as it is applied) today is not an automatic panacea. The quest for sustainable development is certain to pose new challenges to systems analysis, possibly around the themes of self-organizing and evolutionary complex systems, the roots of systemic vulnerability, the analysis of multi-scale linkages, the understanding of interactions between simultaneously unfolding megaprocesses, the treatment of irreducible uncertainty and fuzziness, etc. It may eventually become necessary to go beyond systems analysis by developing complementary approaches. For instance, to train the capacity for perceiving complex systems and intermeshed processes, to develop the skills to combine different forms of knowledge for the apprehension of complex systems as totalities and for deriving appropriate actions.

In this book, I have attempted to sketch a framework for posing new questions and research agendas, rather than to provide a set of answers. But the basic questions remain the following:

- How can poverty be eradicated through sustainable development?
- Is it possible to eradicate poverty while the affluent continue to pursue an unsustainable trajectory?
- Will poverty be eradicated in the foreseeable future?

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[80] For instance, development is often described as a permanent increase (usually of GNP); expressions such as "target", "optimal path", "trajectory" resonate with ballistic analogies. The word sustainability suggests reaching a state of constancy, preserving an existing situation. Therefore the phrase sustainable development intuitively sounds self-contradictory. The argument here is not that sustainable development is inherently self-contradictory (I believe it is not) but that the wording and conceptualization we use are not well suited for the new concepts being generated.

The conflicts between the West and the East have vanished in the last few years. The global threat now is of a deepening chasm between the North and the South. A new sense of solidarity must be nurtured and developed – solidarity among people as well as with the planetary ecosystem. This solidarity must be based not only on ethical considerations, but also on the realization that a) in the long run, it is in the best interest of all to cooperate rather than to confront, and b) intergenerational equity cannot be reached without a dramatic reduction in the large inequities existing between and within countries in the present generation.

Given the present planetary situation, there can be no separate solutions for the sustainable development of the South and of the North: either a global solution is found, or there will be no solution at all.