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THE CONCEPT OF SUSTAINABLE DEVELOPMENT REVISITED*

ABSTRACT. The concept of sustainable development is here revised in the light of a brief historical analysis, followed by a semantic analysis of the expressions **development** and **sustainability**. The authors criticize the common use of this concept in a loose way or in wide generalizations, to conclude, based on the principles of human ecology, that it is only possible to make it operational in limited spans of time and in limited spatial units.

KEY WORDS: development, geosystems, human ecology, sustainability

1. INTRODUCTION

Sustainable development is one of those modern expressions/ concepts widely used although imperfectly defined or formulated. It arose from a rough idea developed in the sixties in the context of conservation of nature and natural resources and entered the discourse of ecologists, economists, agriculturists, developers, and politicians after the Rio Conference of 1992.

The following discussion aims at clarification of concepts and definitions.

It must be noted that it is not the case of discussing the existence or permanence of **self-sustainable** or **self-sufficient** systems. These would be **quasi-closed** systems, only possible in isolated ecosystems with defined boundaries, where man is absent, as islands or lakes.

The delimitation of ecosystems where man is present was discussed by Roy Ellen (1993). He recognizes that *It is becoming ever more difficult to argue that even the most isolated human population and its immediate environment can be treated as an*

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unproblematic self-reproducing closed system. . . . Moreover, it is rare for material exchange suddenly to discontinue at a border . . . Subsistence areas associated with particular local human populations (and therefore ecological systems) generally overlap.

Rappaport (1993) also agrees that, with the exception of small groups of people living on isolated islands or in the Arctic, all human populations interchange products or artifacts and maintain contacts beyond the frontiers of their settlements.

The notion that there is a limit for the total **carrying capacity** of the Earth is old. During the XVIII–XIX Century, it was formulated with more precision and emphasis by the reverend Thomas Robert Malthus in England. Malthus considered the production and availability of food as the key factor in the control of population growth, limiting human expansion.

In recent times, this issue was the theme of four contributions that set the pace and explored the distinct viewpoints that make up the object of our discussions during the last three decades.

In 1968, UNESCO sponsored a conference on the utilization and conservation of the biosphere. The emphasis was on the importance of the preservation of natural ecological systems. Two main conclusions define its main objectives, vz. the conservation and rational utilization of renewed natural resources:

1. *De préserver ou rétablir l'équilibre dynamique de la biosphére*.
2. *De développer des techniques permettant une utilization plus rationelle de ses réssources*.

In the following year, Eugene Odum (1969) published a paper on *The strategy of ecosystem development*, associating the knowledge of the operation of natural recycling systems with the needs of social development.

The publication of a report by the Club of Rome in 1970 (Meadows et al., 1972) returning to the question of the existence of limits to growth, transported the ideas of Malthus and Stuart Mill to modern times. This report received acerb critics and was republished with alterations. It clearly shows the need for worldwide measures for the control of population growth.

Lastly, in 1973 Dasman et al. adopted the viewpoint of man as the primary objective and implied that *Conservation and economic*

development should ideally be directed towards a common goal – the rational use of the Earth's resources to achieve the highest quality of living for mankind.

As Pimentel et al. (1999) aptly defines the present situation in the biosphere, we face a growing world population, now numbering 6 billion people. At a growth rate of 1.4% per year, the population is expected to double in the next 50 years. Malnutrition already affects more than half the population. Famine and communicable diseases have been active factors limiting population explosion among the poor. Migration and urbanization has aggravated the picture, facilitating the spread of diseases of which the current dengue epidemics is a good example (Mott et al., 1990; WHO, 1991; WHO 1993). We must also consider the constant increase in per capita consumption levels in the developed nations; in soil, air, and water pollution, and in the demand for energy. Disruption of natural ecosystems, degradation and species extinctions, reducing biodiversity, are added threats.

2. DEFINITION AND CRITERIA FOR **DEVELOPMENT**

Development may be defined as a planned change, cultural, social, economic, political or ecological in character, towards an improvement in the quality of life. So, it aims at the increasing satisfaction of the basic needs of man, as nutrition, shelter, protection, health and psyco-social factors. Development results from initiatives, among others, in the fields of industry, food production and distribution, transportation, architecture and urbanism, communications, public health, and education – respected the fundamental principle of autonomy of the people concerned, and avoiding the extreme relativisms as fundamentalist or radical beliefs and practices of traditional or religious character. To be sustainable, the process must assure the preservation of the human species in co-evolution with all other species, being understood that the basic unity of conservation is the biotic community, meaning all the populations of living organisms that interact in a given ecosystem or geosystem.

Until the XIXth Century, the development projects did not take into consideration possible impacts upon the environment, as the

local extinction of species or the profound alteration of natural environments, with repercussions far and wide in place and time. Norms and prohibitions adopted in early days were directed at the restricted usage of forest plant and animal products for the use of nobility, land owners, or else for strategic reasons, such as the preservation of stands of trees reserved for ship building. This disregard towards the transformation of natural ecosystems is demonstrated in government incentives to the opening of new frontiers in the United States and in Brazil, or in the explicit declarations as that of the Brazilian president Washington Luiz in the late 1920's who stated that "to govern is to open roads." Colonization and urbanization have proceeded along human history without rational planning where environmental protection is actually taken into serious consideration.

The concept of sustainable development aims at correcting this error.

3. DEFINITION AND CRITERIA FOR **SUSTAINABILITY**

The application of the most fundamental of concepts of general ecology – the ecosystem – to development as defined above, resulted in that much discussed notion of eco-development. It carried with it the ideas of **stability**, **equilibrium**, **self-organization**, **self regulation**, **and self-support**. Let us briefly analyze these notions.

Stability only persists in the biosphere during short periods of time, in the human time-scale. **Equilibrium** in nature is dynamic, and do not conform to the concept adopted by physicists. Along the geologic scale of time, species, biotic communities and biomes have a point of origin, they evolve, and eventually become extinct, or else they change into something else. As to **self-regulation**, **self-organization**, and **self-support**, which are inherent to ecological systems, they deserve a more detailed analysis.

The fundamental property of all ecological systems is the synthesis of organic matter and the recycling of nutrients. It lies in the very core of the concept of **carrying capacity**. We will not elaborate on this, as Lees and Bates (1993) presents a fairly good discussion of this concept, as applied to socio-economic development.

In the first place it is necessary to distinguish between trophic choices of man which are social and culturally regulated, and those of other animals, which are determined directly by physiological needs. Values, intentions, traditions, and consciousness make it impossible to assimilate human choices to the actions of non-human animals, and make it impossible to use models developed for the study of populations of animals and plants. Human populations do not optimize resources, but contrive complex strategies to cope with problems resulting from their actions. As Lees and Bates (1993) rightly concluded, *This has also resulted in the concept of carrying capacity being anthropocentrically redefined in a way that places it beyond empirical measurement: it is defined as the level of human activities that can be sustained indefinitely without "damage" to the system*. Human societies acquired the power of creating solutions through technology, i.e, the application of fundamental laws to the solving of practical problems. At the same time, the over-exploitation of a local recource, such as water, protein, or other essential or superfluous nutrients, do not result in the reduction of the population, but is answered by migration or through the import of the same or of substitutes from beyond the population's geographic limits.

We may say that, where human populations is concerned, **carrying capacity** in the ecological sense was substituted by the **carrying capacity** in the literal sense of transport across borders.

In terms of sustainable development, **sustainability** means the preservation of natural ecological processes based upon energy transfer and nutrient recycling. Those processes, in macro-scale, are those responsible for the conditions that permitted the emergence and evolution of life as we know it. The planning of sustainable development must devise ways to intervene in the natural systems without leading them to progressive disorganization and degradation. The capacity of response of natural systems should be estimated and respected.

Self-supporting communities are necessarily limited in a space-time frame. The idea of a global system able to satisfy the increasing needs and the whims and fancies of consumers everywhere is utopic.

Human societies evolve, so the continuity of sustainability must be viewed as a dynamic process. Priorities and needs vary along the timeline, so the changing process must be able to absorb or to incorporate new technologies and readjust conservation strategies in accord with the new kinds of impact generated by them. Conservation priorities fall upon the biodiversity and the conservation of biotic communities, which are the smallest units of conservation.

4. CONCLUSION

Charles Elton (1958) used the expression *ecological explosions* for the exagerated increase in population numbers, and wrote about it with growing concern. Most arguments he used are still valid today.

Sustainable development is a universal concept, but its operationalization is viable only in a defined microgeopolitical unity, limited in space and time. It is valid for local eco-social systems, respected regional peculiarities.

It may only be applicable to closed systems, where the harvest of surplus energy do not overstep the carrying capacity of the system.

In its current use the expression **sustainable development** lost its true meaning to become a commercial and political jargon, and a plea to the preservation of landscapes.

Sustainable development is a concept easily grasped and perfectly understood when applied to pre-technological human populations, where trophic needs are met by production inside their geographical domain. In urban societies, those limits become progressively blurred until they extend to encompass the biosphere. Products are imported from all over the world, and are available irrespective of seasonal limitations. So, a heavy toll is exacted from the whole biosphere, which cannot be expected to be able to sustain the growing world's population with a minimum standard of living.

Perhaps a new name should be found for what is being currently called *sustainable development*, namely the old question of population growth vs technological development vs environmental resilience.

Anyway, to make this concept fully operational, we need a new ethics. It must be part of the planning process: the need to make urban societies aware of the need to control, conserve and safeguard sustainable conditions of production of the good they consume *in their original areas of production*. We have already achieved a modest degree of success in the cases of preservation of species threatened with extinction, through the passing of legislation preventing their import and traffic. We must now expand the concept, to encompass the whole range of products and services.

NOTE

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REFERENCES

Dasman, R., J. Hilton and P. Freeman: 1973, *Ecological Principles forEconomic Development*. London: J. Wiley.

Meadows, D.H., D.L. Meadows, J. Randers and W. Behrens III (eds.): 1972, *The Limits to Growth*. N. York: Signet.

Ellen, R.: 1993, The Ecosystem Approach in Anthropology. From Concept to Practice. In: E. Moran (ed.), Ann Arbor: The University of Michigan Press, 192–195.

Elton, C.: 1958, *The Ecology of Invasions by Animals and Plants.* London: Methuen.

Rapapport, R.: 1993, The Ecosystem Approach in Anthropology. From Concept to Practice. In: Moran, E. (ed.), Ann Arbor: The University of Michigan Press, p. 58.

Lees, S. and D. Bates: 1993, The Ecosystem Approach in Anthropology. From Concept to Practice. In: Moran, E. (ed.), Ann Arbor: The University of Michigan Press, 248–250.

Mott, K., P. Desjeux, Moncayo, P. Ranque and P. de Raadt: 1990, Parasitic Diseases and Urban Development, *Bull.WHO* 68(6): 691–698.

Odum, E.: 1969, The Strategy of Ecosystem Development, *Science* 164, 262–270.

Pimentel, D., O. Bailey, P. Kim, E. Mullaney, J. Calabrese, L. Walman, F. Nelson and X. Yao: 1999, Will Limits of the Earth's Resources Control Human Numbers? *Environm. Developm and Sustain* 1: 19–39.

UNESCO: 1968, *Utilization et conservation de la biosphère*. Paris: UNESCO.
WHO: 1991, Health and the Cities: A Global Overview. *A 44 Techn.Disc./2*. 35 p.
WHO: 1993, Dengue Prevention and Control. Report by the Director General. *Forty-Sixth World Health Assembly, Prov. Agenda* 18.2.

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