

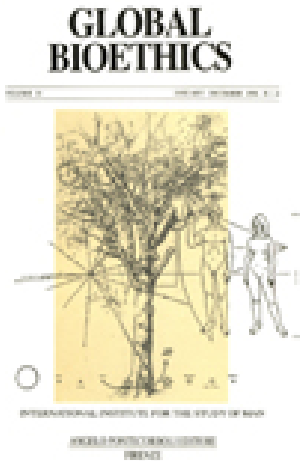
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History of human impact an the natural environment

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History of human impact on the natural environment

At the threshold of the Twenty-First Century, Humankind is facing a new Era. After 6 million years of genomic independent existence and after 2 million years of increased capacity in learning and transmitting information among the members of the group and from one generation to the next which supported an enduring technological tradition, we are now facing the effects of a dramatic and accelerated population growth. In the last two centuries human population size increased from one billion in 1835, to 2.5 billion by 1950. This number then doubled in only 45 years to almost 6 billion. This unprecedented increase in numbers, affecting specific geographical areas, has accentuated the deterioration of the natural environment caused by the misuse of natural resources and the depletion of fertile soils due to the clearance of forests, climatic changes and pollution.

Keywords: population explosion, global bioethics, future increase

1. Introduction

The course of human evolution from six and more millions years ago up to the present has been set up a series of stages. Every stage was made possible by what happened in the preceding ones. Like in the past, each of us can influence the future of human kind with his/her decisions.

Two basic features, marked human evolution: *sociality*, which is the bond that connects individuals in group thanks four stimuli (i.e. mother child interaction, sexual stimulus, co-operation in the search of food and cooperation for the defence of the group) and *intelligence*, (i.e. the peculiar skill of getting, working out and communicating information).

These two features were highly selective factors in all stages of hominid evolution. With the acquisition of erect posture, it was possible to control the environment with a better sighting of potential aggressors and the closeness of conspecifics. The erect posture contributed also to the attacks potential plunder with blunt instruments and to carrying of food into safe places, where it would be possible to share with conspecifics.

Therefore, the acquisition of erect posture is an anatomical feature that can't be considered separately from the emergence of the socialisation processes and from the beginning of the cognitive revolution, started with the control over the environment.

Interaction with the environment stimulated the first adaptive discoveries which were communicated to conspecifics and transmitted to following generations with the linguistic communicative system. The development of lithic technology, 3-2.5 millions of years ago, is also based on this communicative system which began in that period.

The first hominids lived in small migrant groups because food of high protein percentage was not abundant in the environment used. Neither was it available in delimited spaces.

With the constitution of mobile groups came exogamy and demographic fluxes, which not only established new social ties, but also permitted a constant genetic flow. With that flow the acquired positive features were able to spread themselves easily and quickly over the entire population, keeping the genetic pool of the species in general uniform. Sociality, moreover, fixed, the minimum number of individuals necessary for the surviving of a population from one generation to the next, securing also genetic variability (Deme).

2. Demographic estimates for prehistoric Mankind

Archaeological data suggest that during the Pleistocene period, world population was dispersed and never have exceed 10 million. The scarcity of food available and the frequent changes of climatic conditions were the limiting factors.

Table 1 presents a synthesis of archaeological and environmental estimation of Mankind present in the world in different time.

Tab.1 - World population from early Paleolithic to Nowday

Time	World human population in milion	Index of increase (% per year)
Early Pleistocene	0.8	0.00007
Mean Pleistocene	1.2	0.0054
Upper Pleistocene	6.0	0.0100
Late Pleistocene	9.0	0.0033
Neolithic	50.0	0.085
B.C./A.D.	250.0	0.046
1300	400.0	0.022
1650	553.0	0.37
1750	800.0	0.44
1800	1000.0	0.52
1850	1300.0	0.54
1900	1700.0	0.79
1950	2500.0	1.74
1977	4300.0	2.01

Frequent climatic alterations played a decisive role between 14 and 6 thousand years B.C. In that period humankind produced technological and social innovations to get over these unforeseeable environmental problems. The domestication of animals and the cultivation of plants partly solved this food scarcity and were the bases of fixed settlement and of the first demographic revolution. Humanity began to grow with a 0.01% increase. From an imperceptible growth in which 250 Km. sq. were required for the subsistence of 3 hunter – gatherers in the Palaeolithic period while, more expert Mesolithic gatherers were 12 in the same area.

Global population do not exceed 10 millions at the end of Palaeolithic while around 5000 B.C., with the starting of the first sedentary society, the population increased to 50 millions.

The transition to a sedentary life, with the development of breeding, agriculture and the discovery of fermentation made possible a considerable increase in the number of

people who were able to live in a territory (2500 people every 250 Km² for the first communities of farmers, and 5000 people for the next pre-industrial and urban stage).

In permanent territories the deme group of early humans population gave birth to the notion of ethnicity and territoriality encouraged the permanence of cultural diversity by means of regional linguistic differences.

With agriculture and breeding came also the active interaction of man with the natural environment. Territory, deforested with fire, was abandoned when considered not productive anymore and other areas were fired to be utilised for agriculture. Agricultural innovation made possible the constitution of an energetic-alimentary surplus, which got rid of the most important restraint on a demographic increase in hunter-gatherer communities.

From 4 to 3 thousand years b.C. the success in the Middle East of monotheistic religions, with their conception of Man as the landmark in Nature, was a fundamental stimulus to the idea of domination and possession of Man over Earth.

But the frequent and fast numerical increase of population must have caused cyclical energetic unbalances, periods in which people in needs for food exceeded the carrying capacity (i.e. the maximum number of people that could have been fed in those circumstances). These were pre-crisis situations. Frequently in these primitive agricultural societies even moderate seasonal decrease in output caused extraordinary crises of mortality: epidemics, ritual limitations of births, exposure of born babies, elimination of the first-born, (if it was a girl) or limitations of reproductive survival(virgin, vestals, etc.) of a large population.

3. History of demographic increase

At the beginning of the Christian Era, only 8000-6000 years after the Neolithic revolution, humanity reached already 250 millions. The annual increase rate gave rise to a population doubling time of 2000 years.

The annual rate of increase didn't rise a lot from the beginning of the Christian Era to 1750, before the industrial revolution: in 17 and half centuries the annual rate of increase changed from 0.04% to 0.06% (1100 years the doubling time).

At the end of the XVI century the human population was 470 millions, and 750 million around 1750 when 65% lived in Asia, 17% in Europe, and the rest in the other continents.

Population increase from 0 to 1750 wasn't constant. Plague and other diseases and epidemics caused a contraction in population in at least two periods, between 500 and 600 and between 1350 and 1500.

The development of geographic knowledge, with the discovery of new utilisable territories, and the increase of food supply were basilar factors for this following period of increase (Chiarelli, 1992).

The industrial revolution and better hygienic-sanitary conditions, from half of the middle of the XVIII century, accelerated population increase for the first time in Europe, and then in other industrial regions. In the two centuries between 1750 and 1950 (end of World War II), population increased with an average rate 10 times greater than preceding centuries. This rate caused a doubling of the population in less than 120 years.

One billion people was achieved around 1830; two billions in 1925, and in 1950 the

world population was already 2 billions and a half. In 1987 it was 5 billions. In 2000, we'll exceed the 6 billions.

In the last two centuries the increase in life expectancy at birth, the accumulation of resources and man's control over the environment have been contributing to demographic increase.

Furthermore, the last 50 years (from 1950 to the present) must be considered as a period in itself, not only because of the huge global rise of the annual rate (more than doubling of the population), but also because this rise pertains to some geographic regions in particular.

As a matter of fact from 1950 to the present the average rate of increase per year in the world is 1.8% but it's only 0.6% in Europe, while it's over 2% in Asia and America, and 2.5% in Africa. European population, which at the beginning of 1900 was 18% of the world population, nowadays is less than 10%, and is going to go below 5% in little more than a century. These changes in proportion between different human populations also have an anthropological relevance (Table 2).

TAB.2 - Populations in millions estimated between 1900 and 1950 and projected to 2000 (from the UN publication, "The future growth of world population") and rate of increase 1900/2000. Note: the data for the entire USSR is include in Europe.

Year	1900	1925	1950	1975	1990	2000	1900/2000
World	1550	1907	2497	3828	5248	6127	3.9
Africa	120	147	222	383	645	877	7.3
N. America	81	126	168	240	292	312	3.8
Lat America	63	99	163	300	480	592	9.4
Asia	857	1020	1380	2210	3057	3544	4.1
Europe	423	505	574	751	790	828	2.0
Oceania	6	10	13	21	27	30	6.0

Population doubling, which only a few centuries ago occurred over thousands of years, nowadays is a matter of some decades (38 years). This phenomenon has been defined as "biosphere cancer" by American biologist Hern Warren (1995).

In a large number of areas of the so-called Third World, in spite of shortage of food resources, population is growing at a dizzy speed. This is a consequence of the submission to western cultural patterns, and of better hygienic conditions acquired with the defeat of a lot of diseases.

A huge difference exists, for instance, between the southern and the northern coast of the Mediterranean sea: an average of six children per woman on the southern coast, less than 2.1 on the northern.

Therefore an increase in immigration over the next few years, from south to north, is inevitable.

But, what is the number of people sustainable by the earth? What about the scenario to come?

4. What about the future?

The world population around 2020, according to U.N. estimates, will be 7-8 billions. If the fertility rate is 2.1 children per woman, world population will be 10 billion in 2050, and will reach a lasting balance about 11.6 billions at the beginning of 2200.

These figures can change according to the assumed fertility rate. If fertility were about 2.5 children per woman, world population would be 28 billion in 2150, an amount not tolerable at all by the planet. Nevertheless nowadays the average number of children per woman is far from the 2.1 rate in most parts of the world (1.1 in Germany, 1.3 in Italy), but women in Africa produce more than 6 children. In south Asia and Latin America the rate is still close to 5.

The situation is even more alarming because life expectancy at birth is increasing, particularly in those countries which are contributing more to population increase. U.N. experts estimate that up to 2025 the 70% of the supposed population increase will be in only 20 developing countries: India, China, Nigeria, Pakistan, Bangladesh, Brazil, Indonesia, Ethiopia, Iran, Zaire, Mexico, Tanzania, Kenya, Vietnam, Philippines, Egypt, Uganda, Turkey and South Africa (black population).

International organisation as the U.N. promoted conferences in Cairo on population and development and in Peking on women. In this meetings some methods were suggested for obtaining a slowing down in population increase by means of a decrease in fertility: promotion of modern contraceptive methods, incentives for economic development in the so-called Third World, better life conditions for new-borns and children, progress in women's conditions and in education.

Many countries are trying in some way to decrease birth rates, and to improve human life conditions in spite of the intrusiveness of some ideologists. Among the tested methods we find the severe Chinese governments imposition of one child per woman, the renewed encouragement to puerperae for long term breast-feeding, the effort to bring out the value of women in society.

Three features are involved in the problematic future of humanity on anthropological grounds: a) globe carrying capacity problem, b) the problem of differential increase among human subgroups (national, ethnic or biological subgroups), c) the increase of age old peoples in industrial societies.

The problem of differential fertility among different world populations and of the increase in the number of aged in industrialised areas has an immediate anthropological impact on human well-being and social relations. Humanity has to maintain a balance with Nature, but also with the different genetic pools, avoiding their extinction, as a balance is necessary between sexes and age in generations. But, among all these problems, the carrying capacity is the most crucial for human survival, and gives more worries on ecological and ethological grounds.

5. Ecological and ethological worries about the earth's carrying capacity

Humanity has only a few hundred weeks left to plan responsibly for its demographic future and its consequent impact on the biosphere for the next century. By now scientists, politicians and theologians have little time left to think about the problem. They have to revise their positions about problems that concern the interaction between our species and the environment; but their cultural background about the basic features involved in this man-nature relation is weak, sometimes very superficial. Indeed it seems that quite

often leaders responsible for guidance are replaced by a collective social intelligence, that faces and resolves in autonomous way ethical and moral problems.

Some experts say that new bio-technologies will be able to offer us enough alimentary and energy resource, as happened in Neolithic times with the discovery of taming, agriculture and fermentation. But they forget that the Neolithic period lasted 6000-8000 years while the post industrial transition we are living is lasting just generation time. Crucial decisions about human survival in the future are likely to be taken in the few weeks that separate us from the beginning of the third millennium.

But on what grounds is our future going to be planned? What kind of life and world do we want to leave to our children?

The U.N. demographic projection says that in 2050 the Earth's population will be inexorably included between 7.8 and 12.5 billion. Then, it will begin to decrease.

Is the Earth able to face this population projection? And if so, under what conditions of life?

Anton van Leeuwenhoek already in 1679 estimated that 13 billions is the maximum population that Earth can carry. Other geographers and demographers estimates a variation from a minimum of 1 billion to a maximum of 1000 billion. Such different estimates give rise to deep scepticism.

During the Rio Congress in 1992 some economists urged that every single country should value its human carrying capacity. Even if some specific resources, like mining deposits, can be defined region by region, the knowledge, the energy and the technology for the exploitation of local resources quite often depend on other countries. Human carrying capacity can't be defined at a national or regional level. Moreover, all of us share the same atmosphere, oceans, climate and bio-difference in global resources.

As a matter of fact, human carrying capacity depends on natural limits (not yet completely defined), and on individual and collective decisions about the distribution of welfare products, the use of technologies, political institutions, the ideologies that guide populations family structure, the tendency to migration or the adaptation to urbanisation. In other words, it depends on how many people will eat meat or sprouts, how many will ask for parks, and how many want parking places, how many want maize fields or tobacco. These are the choices that are going to condition, the number of people that the Earth is able to carry.

In 1798 Thomas R. Malthus described the dynamic relation between human population and a country's carrying capacity with this passage: "Welfare doesn't depend at all on a country's poverty or wealth, on its young or old age, if it's more or less populated, but it depends on the speed of its development, on the relation for each year between the alimentary resources increase and population uncontrolled increase... in simple words, the economy of a population is the contest between two rates of increase: the one of population and the one of economic output"

In a recent article on Science (1995), J. Cohen tried to integrate Malthus-Condoret and Mill's population increase model with the Earth's carrying capacity. He suggests an interesting equation. In order to explain difference between the trajectory of Earth capacity $K(t)$ and human population dimension $P(t)$ in the last 2000 years.

According to this pattern the 17th century acceleration of population increase was proceeded by a long period of increase in the carrying capacity (Cipolla 1994). New territories like the Americas and Australia, at the Old World people's disposal with their resource, was certainly a concrete contribution to this phenomenon (Chiarelli 1992).

Only new technologies and new energy resources can offer concrete opportunities

for a future increase of population (Repetto 1985, Perace *et al.* 1993).

But new technologies caused new pollution and environmental damage. The rise in population increases primary forest felling, contributes to the erosion of the Earth's surface and to the production of chlorofluorocarbons and plutonium. Moreover prossemic problems caused by rising urbanisation have to be solved by an ethological and cultural approach.

To restrain population increase is therefore urgent and necessary. The major scientific authority of the Catholic Church, the Pontificia Academia delle Scienze, seems now being in agreement: "The necessity of a global limitation of births is unavoidable" A purpose that has to be reached "with all the intellectual and moral energies of humanity, in respect of social equity and fairness to various religions in the world and to actual und future generations".

Therefore a global restriction of women's fertility at less than a two children rate is a necessity tied to Mankind's survival, as underlined in the recent conference in Peking.

6. Anthropological evaluations and perspectives

Nowadays people have to be ready to accept the notion of a natural history of man. Everyone must appreciate human evolution and the difficulties overcome with obstinacy during human history, from its origins. In this way one can well understand the cultural and technological evolution of the present. The example of the past is the key to understand the present and foresee the future.

Experts of present population and planners of the future have to consider demographic increase and its causes. Anthropology, in the sense of the Natural History of Man, not only satisfies our curiosity about the past, but also, and first of all, has a greater and greater importance in understanding our place in the natural world. That's our way to confront the environment and face future adversities. Nowadays humanity has to reconsider the idea of Nature, has to give to the interaction with it a new value. Ethics has to recover its social milieu, including Nature, setting the Earth free from the domination and exploitation idea. That's what was suggested by A. Leopold in 1939, and new warmly revived as an idea of an ethic of responsibility by van Potter (1992) and Jonas (1990).

Man begins now to look at nature as a supporting milieu for life (ecology), as his very substance. A substance common to every other living being (comparative biology, DNA as unity of life). While man knows Nature, he has also to get the idea that he is part of it.

So we'd better say that Nature thinks of itself through the human brain.

This follows the anthropic interaction between human consciousness and his knowledge of Nature: a reflection of mind on substance, in which mind is the substance itself. In other words, as already said by Teilhard de Chardin: "substance is full life, life rises to conscience and mind".

But this period of reflection is dimmed by the risk of ecological disaster and by a catastrophic increase of human population which not only restrains knowledge development, but undermines human life itself.

The adaptive choices of human social structures and the ethical choices themselves (which are biotechnological and medical too) are a consequence of this interaction between human population and the natural environment: a balance that must be preserved for the survival of our species itself.

The natural world may not be interested in human survival. Man himself, *Homo sapiens* is the result of biological evolution just as are the other living species. As it has

already happened, and keeps on happening with other species, if man complies with an unlimited reproduction and an unruly abuse of resources he can cause his own extinction, and the extinction of other species of plants and animals.

Bioethics is therefore a basically anthropological and naturalist science, which tries to set up a pact between Man and Nature to make our life on this planet still possible.

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