

Towards ten billion human beings on Earth?

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Potsdam, 27th May 2008

On every second the population of the planet grows with three new human beings being born, mostly in the developing countries, two hundred sixty thousands every day and 90 millions every year. Every 200 days a new population as large as the one of Italy is born, grows and makes use of the resources of the planet.

Such an impressive growth and development of the human population is one of the most extraordinary evolutions of the planet Earth and will definitely modify the future of mankind and the one of every other animal and vegetal species. During the 4300 million years of the solar system, the appearing of the *homo sapiens*, the development of the speech, languages and the fire all occurred less than one million years ago, namely in the last 20 seconds of the “day” of the solar system.

How many human beings were alive a million years ago? The answer is very simple: about 100 000. At the time of the last glaciation, when the passage between Asia and America was open to walking, the human population was between 1 and 5 millions. About 7 thousand years ago, when the population was between 1 and 5 millions, a fast growth of the level of the seas, of over 120 meters, has probably been the cause of a fast catastrophic event (the universal deluge) of which traces are retained in most of the mythologies and in the Bible, probably the poetic message of a real event, perhaps the break-up of the isthm of the Bosphorus and the flooding of the Black Sea. From this moment, the level of the sea and more generally the climate reached the absolute stability that has been the first cause of the extraordinary, subsequent development of the human species, a stability which unfortunately today man may destroy in a short time to come.

Initially, most probably from Africa, man progressively invaded the rest of the planet Earth, taking advantage of climate changes and of glaciations, recently so well described by Cavalli Sforza, with the help of results based on DNA. It remains as a mystery which was the role of the Neanderthal man, who appeared mostly in the South of Europe, very similar to the Cro Magnon man and who has been extinguished mysteriously about 20000 years ago. It is not clear if the Neanderthals could have merged with our ancestors or if they were a completely different race without possibility of fertilization with Cro Magnon. We do not know whether it was because of a war/extermination by the Cro Magnons or an illness that the Neanderthal man so abruptly disappeared. In a few years such a mystery may be perhaps resolved with the help of the DNA.

At the times of the Neolithic, of Mesopotamia, of Egypt, of the written language and of the first agriculture we were about 10-15 millions on Earth. At the beginning of the Christian era we were between 100 and 250 millions. Around 1500, well after the time of the fall of Rome, the first Universities, the geographic discoveries, the printing were all created by a population of 400 to 500 million individuals. We must wait for the Industrial Revolution, modern medicine and so on to arrive to the first billion of people in 1850. For the second billion we must wait for the year 1930, which incidentally is around the time I was born, for the third billion the year 1960, for the fourth the year 1970; today we are approaching the mark of 6.5 billions. During the short period of my own life, the population has been multiplied by a factor four and the energy consumption by a factor sixteen.

Today the population grows at the rate of about one billion units every decade. Never before had anything similar occurred. The total number of individuals who have lived in the whole history of our planet are estimated between 80 and 150 billions. Today there are around about 6 to 9% of human beings who every existed on Earth, moreover in a rapid increase.

The food represents the most elementary amongst all needs of every animal species, evidently including man. Agriculture nourishes more or less correctly 6.5 billion human beings. More or less correctly, since it does not prevent 850 millions amongst them to suffer hunger. But in which way will it be possible to respond to the increase of the demand represented by the 9 billion people who will be around by 2050 and maybe 12 billions by 2100? This is a problem which churns the international community, although less than the one of global warming and the lack of water, although it is strictly connected to them. But it represents, just like these, a challenge of planetary dimensions, that will represent an additional impending threat for humankind in the near term future.

Some alarming signals have already begun to appear. The world's reserves of cereals have substantially diminished during the recent years: after having represented for decades a reserve of at least six months of global need, they are today approaching less than three months. The price of food commodities, which for a long time had represented a tendency toward a decrease, is now undergoing a strong pressure towards the rise. The demand grows faster than the offer. The price of rice, which is a main supply for about one half of the world's population has increased by a factor three.

But what is the problem? Agriculture has well coped with an increase of the population of four billion people during the XX century: why can we not manage with an equal success an additional growth of several billion people in the next forty years, in order to reach the date of 2050? In reality the situation for the future is very different from the one of the past, when we have done easily more with the help of additional resources: more land, more mechanization, more chemistry, all with cheap and abundant energy. Tomorrow, instead, we will have to do more with less.

Land: Between 1945 and 2000 man has put to production more land than during the XVIII and XIX centuries together. But today, the physical limits of the planet are approaching. Even if virgin lands still exist in the Amazon, in Africa and in tropical Asia, they cannot be conquered without destroying forests, essential to the ecological balance of the planet and without creating enormous environmental problems, for instance accelerating the global warming. Furthermore, from the other side, the agricultural land disappears under the effect of urbanization, erosion and the presence of salty waters.

Water: During 1950, each human being had the availability of 16800 cubic meters of soft water. In 2025 there will be only 4800. Agriculture has been able to increase strongly the productivity with the help of massive irrigation of 200 millions of hectares created during the XX century. But these times are over. The existing dams have been those that were the easiest and less costly to build: in the future they will be much more complicated and more expensive. The underground sources of the globe are solicited in a free-fall mode. Climate change, reducing the extent of the glaciers, reduces the summer flow of rivers. During the XXI century we shall be able to irrigate at the most 400 million supplementary hectares. And electricity, also in fast growth, is a massive consumer of water, with 5 litres for each kWatt produced.

Chemistry: During the XX century chemistry has provided a “miracle” solution, with nitrogenized fertilizers, well more efficient than the animal or bird excrements previously in use. But an equivalent miracle solution does not exist for the XXI century.

Biology: We must look for other solutions, a possible way being biology, maybe a miracle solution of the XXI century, capable of preserving the environment and on the same time improving efficiency. Chemistry had made the production artificial, supporting it with many products made by man, like for instance fertilizers and pesticides. Biology has instead as a task the one of returning to nature, searching the basic functions of the plants and making them more efficient, soliciting and

accelerating natural mechanisms. But the use of genetically modified organisms (OGM) encounters mayor oppositions, in Europe strongly supported by the media.

On a more general ground, the biologic revolution represents today more a promise than a reality, which requires a huge amount of research in order to give the full dimension of the potentials and on a timescale which is very short in order to allow the required changes. It is not easy to imagine how Governments and local communities will be able to organize themselves and the market adapt itself to such a change in such a short time.

Like in the case of energy, also with regard to food there are enormous differences between the advanced and the developing countries. But improvement factors are possible also in this field, with increases of the efficiency, modifying the quantity and types of food in order to create space for the newcomers. The most important is represented by the animal breeding that uses much more calories than what it produces. The ratio is four to one for the chicken and the pork and it raises to 11 to 1 for the ram of the ox. One kilogram of grain requires on the average 1100 liters of water; a kilogram of ox, 13500.

And these values are in continuous growth. For instance during the fifties the French were using annually far less meat than today: 44 against the 88 for meat, 10 against the 25 for fish and 5 against 18 for cheese, compensating the reductions in bread (112 against 60) and of potatoes (153 against 65) with animal products.

Today China produces slightly more milk than France (29 against 25 billion liters), not withstanding a population twenty larger. But what would happen if instead, as natural, countries in full development, like China and India and so on, traditionally poor of breeding animals, would approach progressively the kind of food supply for instance of the US, with the powerful multiplying factor due to the passage through meat breeding?

Contrary to what is generally believed in the advanced countries, the food supply is not only a problem of the past, but one of the main uncertainties of the future, even if, so far too often, if we look around us the general concern seems not to go to the question of how we are going to nourish all people of the world but to the one of making most of us loose weight!

No doubt, the most influent politicians must not neglect the best information specific to those with the highest competence and deepest experience in these fields. Without these contributions, the political arena may become void of real contents. As well said by Macchiavelli in *The Principe*, the true political power is based on the capacity of predicting the main events of the future well before they are visible to all, since by then, in this very moment in which everybody sees them, there may no longer exist any possible solution.

Thank you!