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## EDITORIAL

### Does the population issue still have a valid place on the environmental agenda?

Jan Boersema

In 1798, T.R. Malthus published his famous *An essay on the Principle of Population*, in which he discussed the relationship between population figures, population growth and the use of natural resources. Malthus predicted great problems – vice and misery – because the population was growing at a faster rate than food production. He was not the first to broach this subject, it is addressed by the Greek historian Herodotus (484–c. 425 BCE), but Malthus was the first to put it in a global perspective. His work is still referred to today. In the second half of the last century, The Club of Rome took up the theme in their famous report (Meadows et al. 1972) and the biologist Paul Ehrlich showed himself to be an unadulterated neo-Malthusian. His books, *The Population Bomb* (1968), followed by *The Population Explosion* (1990), which he wrote with his wife, were both bestsellers. He focused not so much on the amount of food available but on mankind's total impact on the natural environment. Ehrlich believed that this impact was more than the earth could sustain and he, too, predicted disaster. The world would face hundreds of millions of starving people due to food shortages. But little heed was given to his warning. It seemed to have been set aside or overshadowed by other problems. Were Malthus and Ehrlich too sombre? Or are we indeed headed for disaster? Has the population issue been taken off the environmental agenda unjustly, or is it right to have been overshadowed by problems, such as the threat of climate change and the loss of biodiversity?

#### The need for a stable world population

It is obvious that the world's population will not keep growing indefinitely; it will eventually reach its limit. After a period of time, it will exceed the earth's capacity to provide for it, for the simple reason that every person impacts the earth's natural resources to some extent. To achieve a sustainable world we will need to stabilise global population figures at a given point. But where exactly is this limit? How many people can the earth sustain and what does that figure depend on? In the time of Herodotus, the world population was estimated to be around 250 million. By 1800 that figure had gradually increased to 1 billion and by the time Ehrlich wrote his book it stood at 3.6 billion. During the 18th century, the rate of population growth increased, but over the last few decades it has declined and now, in the 21st century, the figure is expected to stabilise in the second half of the century at somewhere between 8 and 10 billion (Lutz et al. 2001), which prompts the question of whether population is still an environmental issue. To answer that question we first need to

discuss the dynamics of world population followed by the mechanics needed to reach a stable population figure and finally the question of how many people the earth can sustain and under what conditions.

### **Demographic transition**

For centuries, high rates of both birth and death led to only a slight growth in population figures. Death rates among children were particularly high. Because of this, until c. 1850 AD, percentages for population growth in human societies rarely grew to above 0.5%. Furthermore, alongside periods of moderate growth rates, there were, generally, also times in which sickness, scarcity or famine caused population figures to stabilise or even decline. Infectious diseases, such as the plague, smallpox, tuberculosis and malaria wiped out huge sections of the population. It is only since the middle of the 18th century that we see positive growth figures sustained over a longer period of time, first in Europe and then elsewhere in the world. In addition, the growth percentage also increased and there was exponential growth. This was a result of death rates starting to decline before birth figures did. It was only after many decades that birth figures started to fall back too. This shift, from high birth and death rates, to a decline in the death rate followed by a decrease in birth rate is known as demographic transition. The steadily growing difference between high birth figures and death figures that continued to decline created a huge population increase. The longer the period of transition, the greater the increase. Most developed countries have gone through this demographic transition and now have low birth and death figures. The replacement level, whereby there is no net growth in population, is theoretically 2, but practically 2.1 births per woman. If this figure decreases, then population figures will eventually drop. The rate of this decrease, however, can be slowed down, or speeded up, by a change in the average age a woman has children and by changes in life expectancy. On the continental, regional and national levels, population figures are also dependant on emigration and immigration. If more people arrive than leave in any given time period then there is a migration surplus. Over the last few decades, a migration surplus in many European countries has led to modest growth, even though the number of births among the indigenous population was already lower on average than the replacement level. If migrants come from countries or cultures with higher birth figures than the indigenous population, then migration can have a long-lasting impact; it can take many generations before the demographic patterns of the migrant population matches that of the indigenous population. Globally, population growth is declining, and the underlying pattern leads us to expect a stabilisation in population figures in the second half of the 21st century (Cohen 2003).

### **Prosperity and education**

The most important factors contributing to lower growth percentages are economic prosperity and the education of women (Livi-Bacci 1997). The more prosperous a country, measured by increase in its GNP, the lower the growth percentage. So for this reason too, it is necessary to reduce poverty and increase levels of social security. There are still many countries where if you have children you are guaranteed, to some extent at least, to be looked after in your old age. Alongside prosperity, the level to which women are educated is also very important (Schultz 1994). As

soon as women are in a position to receive an education, they start to desire, and achieve, more control over their own lives. That leads to a reduction in the number of children and a resultant decrease in population growth. In practice, these two factors often reinforce each other, since an increase in wealth creates more educational opportunities. But they also operate independently. This is revealed in comparative studies between countries with, and without, educational programmes for women, but with corresponding levels of prosperity. Specific family planning programmes are much less effective than is often assumed, with the exception of the state-enforced one child policy in China. The effectiveness of modern birth control methods is dependent on other factors; they have little effect in and of themselves (Pritchett 1994). Providing information and making birth control easily accessible has little effect if circumstances are unfavourable, such as prevailing poverty and illiteracy. It is only when the economic and educational preconditions are in place that this will have any impact. Of course, while the economy and educational opportunities are powerful factors, they do not affect all members of the world's population equally. Certain individuals and groups within society uphold philosophical or religious beliefs that cause them to value large families. This is the case for example amongst orthodox Jews, the Protestant Amish community, some Catholics and certain branches of Islam. Increasing wealth and educational opportunities within these groups has less influence, although we often see a decrease in the numbers of children over a longer period of time. However, these numbers remain considerably higher than the replacement level. Currently, these groups are too small in size to reverse the global trend towards stabilisation, but they will grow if this difference in birth rates continues, especially when seen proportionately.

### **Environmental impact**

According to Ehrlich, population size was the most significant factor in determining environmental impact, much more important than the nature of the technology, seen as the major culprit by Barry Commoner in his *The Closing Circle* (1971). In the early seventies Ehrlich and Commoner fought an academic battle on this subject, resulting in the well-known  $I = PAT$  formula (Commoner 1972; Ehrlich and Holdren 1972). In this formula, the environmental impact  $I$  is equated to the product of the number of people  $P$ , the number of consumed products and services as measure of affluence  $A$ , and the environmental impact per unit of product, or service as measure of technology  $T$ . It is an analytical formula that describes the relationship between these variables in a quantitative way for any particular case (Dietz and Rosa 1994; Boersema 2009). The equation seems to suggest that the contest between the two authors ended in a draw. Both factors are apparently important and both contribute to the final impact on the environment. Commoner rightly drew our attention to the polluting and wasteful way in which we handle energy sources and raw materials in our economy and advocated a technological revolution. Ehrlich correctly pointed out that if we are not able to stabilise population growth in time, we might be biting off more than we can chew. But the measure advocated by Ehrlich, an active and specific political approach to population control, turned out to be much less effective than the measures that Commoner supported, which amounted to a permanent increase in eco-efficiency in the production of goods and services.

**Hurdle**

Improvements in housing, nutrition and medical care have led, or are leading, to a decline in the number of child deaths throughout the world. Now, at the beginning of the 21st century, almost all countries have begun their demographic transition (the countries of central Africa) or are in the middle of it (countries such as Mexico and Indonesia). Most developed countries have come through the transition and are now being confronted with stable or even falling population figures (Europe and Japan). The challenge during the coming period is to see the fast-growing, generally poor countries through the demographic transition (Galor and Weil 2000; Hilderink 2000). If we want to stabilise  $P$  on a global level, we need to increase prosperity ( $A$ ) even further in the poor parts of the world where population growth is highest. This is a necessary condition for lower birth rates but it is not sufficient on its own. Raising  $A$  does not just mean economic growth but also more financial leeway for educational opportunities; if these are aimed at women then two birds will be killed with one stone in the efforts to reduce birth figures. However, an increase in economic prosperity will also increase environmental impact. This is a hurdle that needs to be crossed in the process of achieving lower birth figures. How do we stop this hurdle destroying us because the earth's capacity to sustain us has been exceeded?

**Green deal and technology transfer**

Stabilising world population is a necessary condition to reducing environmental impact to an acceptable level but is not sufficient on its own (Cohen 1995; Pimentel and Pimentel 2006). We are interested in the total impact caused by each single person. Calculations show that the current impact on the environment, caused by the present global population, is already too high (Rockström 2009). The ecological footprint is used widely to measure this impact (Wackernagel and Rees 1996) and is a tool that is constantly being improved. It gives, in a single and telling figure, an indication of the total burden mankind imposes on the natural environment. Its application shows that the current population of 6.5 billion uses around 1.3 times more resources per year than the earth provides. A safe level for our planet would be 1. So, we are living above our means and continued growth towards a stabilisation of between 8 and 10 billion will require a considerable reduction in our environmental impact, and given the differential impacts of North and South most notably in the rich part of the world. Not only per capita but eventually also in absolute terms. That means we have to look at factors  $A$  and  $T$ . Since, in the poor parts of the world, it is necessary to raise  $A$  in order to stabilise  $P$  there too, it is absolutely vital that  $T$  is lowered on a global level, in other words, the impact per product and service. Historical studies show that in the past population growth had a positive effect on developments in technology (Kremer 1993). However, up until now these were not enough to keep up with the sharp increase in  $A$ , hence leading to a net increase of pressure on the environment. The eco-efficiency by which we achieve our economic wealth needs to be drastically improved and altered. In practice, this means much more than cleaner production methods and a reduction in carbon emission. It also means fundamentally different production processes that are organised in a different way and use different raw materials. This aim of maintaining or even increasing prosperity while ultimately reducing environmental impact, is known as the factor X debate (Reijnders 1998). To ultimately reduce environmental impact it is also

necessary to cut back the amount of material that circulates in our developed economies. The human appropriation of the net primary production is too high (Haberl et al. 2004). Thermodynamics teach us that the transformation of matter and energy can not occur without loss taking place. In many proposals for a new energy system, this is overlooked or underestimated (Bossel 2006). A full cradle to cradle is not possible, even though some appear to think so (McDonough and Braungart 2002). This demands that developed countries undergo a reorientation of their economies comparable to the social and industrial revolutions of the past, hence the use of the phrase Green Deal. Only through such a revolution can the earth feed the projected population figure of 9 billion (Paillard et al. 2011). For the developing countries and the fast-developing economies of the BRIC countries for example, we can only hope that they will find a short cut, so that they do not need to travel the same polluted route to prosperity as their predecessors in the West. This requires international cooperation and in many cases a prudent exchange of (environmental) technology; a transfer that respects differences in culture and industrial interests. The development and the implementation of smart technology are vital to every scenario. To get the most out of this technology, it must be accompanied by extensive greening of economic structures, enhancement of a socially strong democracy and the education of (particularly) women (Sen 1994).

Forty years on, looking back at the IPAT debate between Ehrlich and Commoner, we find that they each identified an important determinant of environmental impact, but that the strategy recommended by Commoner was, and is, much more effective than Ehrlich's. A recent article written by the Ehrlichs reflects on their earlier sombre prediction (Ehrlich and Ehrlich 2009). In it they suggest that the famines they predicted, with the loss of hundreds of millions of lives, did not actually take place because of the green revolution in agriculture. They had no way of predicting such a spectacular technological development. That is of course true, but neither did they provoke it by recognising or stimulating technology as a necessary part of the solution. In fact, quite the opposite, they were part of a movement that spoke out against technology. That same movement not only tried to hold back the development of nuclear energy – a threat to the environment, but also tried to stem the development of green and smart technologies. If there is a reproach to be made it is that they still do not appreciate this.

To conclude: As long as population figures are rising and the resource consumption per head remains high, the population issue is still important, also from an environmental perspective. Stabilising the global population is, and will remain, necessary. While this process is already underway it requires other instruments than specific population policies (Sen 1994). In that sense, it is not a pressing issue. Tackling poverty and educating women both emerge as key factors. To keep the environmental impact of a population that is striving to become stable within the limits of what the earth can sustain, and maintain, different types of economy and green technology are both essential. Commoner pointed us in the right direction.

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