

# The Importance of Global Population Growth

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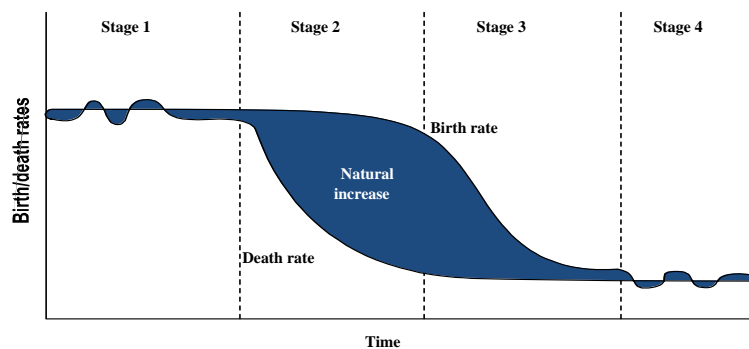
At a Population and Sustainability Event  
Hosted by the Catalyst Group on February 28<sup>th</sup> 2006 in London

The pace of growth of the world's population increased markedly through the last century. While the pace is slowing this century, we must anticipate a further 50% increase in the world's population by 2050.

Figure 1 provides the basic population dynamic underlying a rapid increase. In Stage 1 a society experiences both high birth and death rates and the population stays roughly constant. Since the highest death rate is amongst babies and toddlers the control mechanism is by these people not growing up to have children themselves.

Figure 1

## The Classic Stages of Demographic Transition



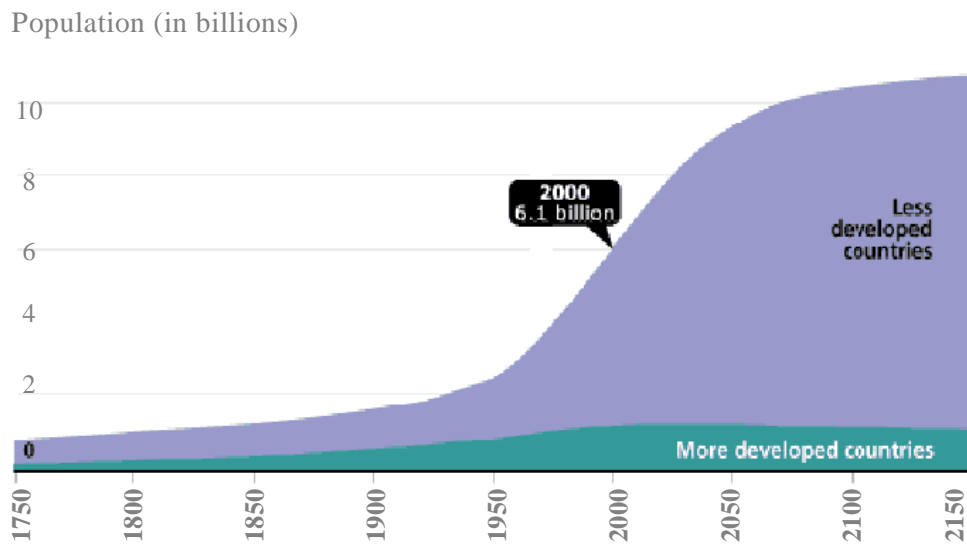
Note: Natural increase is produced from the excess of births over deaths. Source :  
w w w .prb.org

In Stage 2 mortality rates start to decline, typically among babies and young children, due to significant improvement in living conditions, but birth rates stay high – this is the period of great population expansion. In most societies this is followed by stage 3, where there is a sharp reduction in birth rates and the period of rapid expansion slows to a new stable state seen in Stage 4, where once again birth rate and death rate are in balance. The UK went

through this period at the turn of the 19th and 20th centuries. Less developed countries have experienced the onset of stage 3 at varying times since the Second World War and have moved through stages 2 and 3 at different speeds.

Figure 2 (a)

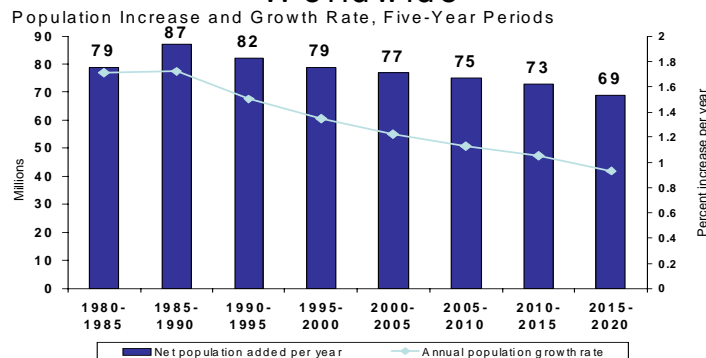
## World Population Growth 1750–2150



Source: United Nations, *World Population Prospects, The 1998 Revision*; and estimates by the Population Reference Bureau.

Figure 2 (b)

## Trends in Population Growth Worldwide



Source: United Nations, *World Population Prospects: The 2002 Revision* (medium scenario), 2003., downloaded from [www.prb.org](http://www.prb.org)

The time between Stage 1 and stage 4 in Figure 1 is the period of rapid population expansion: this time lag is therefore critical. Figure 2 (b) illustrates the lag between changes in the rate of growth and the net increase in world population per year. During the period from 1985-1995, the population growth rate declined (a reflection of declining fertility), yet millions of people were added to the world's population (which peaked around 1985, when 87 million people were added each year). From 2000 on, the growth rate continues to decline, but between 2015 and 2020, we will still be adding 69 million people each year. This is because the generation of women now having their children is very large as the result of high fertility in their mothers' and grandmothers' generations.

The number of women in their childbearing years has increased since the 1950s and is projected to continue to increase through 2050. This is a result of high childbearing and decreasing infant and child mortality. It is worth noting that while infant mortality has declined everywhere in the past few decades the percentage declines have been higher in the North than in the South leading to increasing disparities.

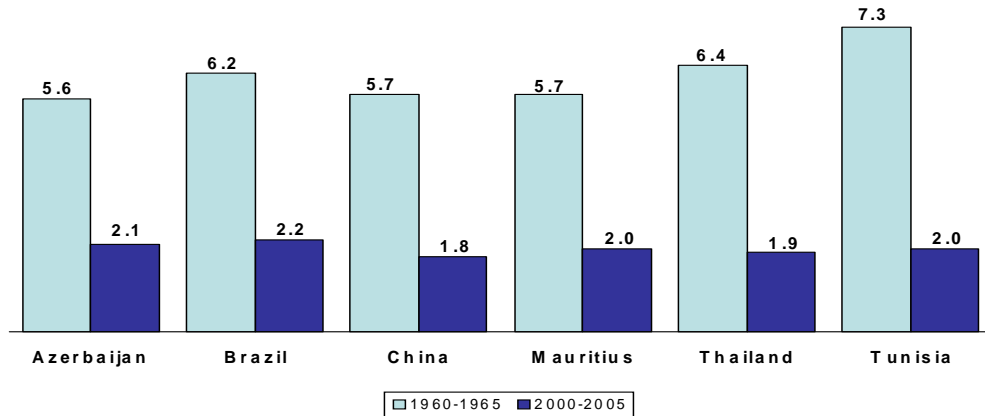
Even though women have on average fewer children than their mothers, the absolute number of babies being born continues to increase because of the increases in the total number of women of childbearing age. For a modern society's population to be stable the female fertility rate should be 2.1.

The decline in global childbearing rates towards this 'replacement' childbearing figure has been led by major declines in a variety of places, many of them big as shown in Figure 3. Typically the reason has been widespread availability and uptake of family planning either through government sponsorship as in China, Thailand or Tunisia, or through more informal mechanisms, e.g. in Brazil. The underlying reasons – was the uptake of family planning the direct result of a government programme or indirect because demand was triggered by macro economic success or failure? – have been the subject of much debate. I would argue that in most cases it's a mixture of the two, but in general, where they can, mothers will have sufficient children to meet the demand that several survive into maturity.

Figure 3

## Reaching Replacement Fertility

Average number of children per woman



Source: United Nations, *World Population Prospects: The 2002 Revision (medium scenario)*, 2003. downloaded from [www.prb.org](http://www.prb.org)

The decline in the birth rates in some of these major societies coupled with the resulting global decline have taken population growth somewhat off the front of the policy agenda. Regrettably, there was no World Population Conference in 2004 following those in 1974, 84 and 94.

I note that the trend towards major declines in population growth has not been uniform. In many countries either the decline has not been great, e.g. the Yemen, or has stalled, e.g. Nepal and Egypt. This is particularly the case in parts of Africa (not shown) particularly in Western Africa. This has led to a number of observers arguing that continued rates of population growth in some parts of that continent are the biggest risks to development for Africa. What are those risks and what are the solutions?

This has always been one of the big questions. Ehrlich particularly argued this as a problem and concern dates back to Thomas Malthus who argued that high population growth rates could lead to food riots on the streets of London by 1840 (as an aside he argued that the only solution was to keep men and women apart until they were 30). Now people look at whether enough calories can be produced to feed the projected world population - assumed to reach around 9 billion towards the middle of this century (Figure 2(a)). The following arguments come from the work of the agricultural economist, Vern Ruttan, but most people would agree with this as there have been major gains in food production over the past 20 years - in many parts of

the world such as Indonesia and Pakistan rice yields have gone up with the development of new strains which permit greater numbers of crops per year. This is commonly known as the second agricultural revolution, although it should be noted that it did not occur worldwide.

Feeding a worldwide population of 9 billion can be achieved but only if growth rates in food production in the future are the same, at least, as those in the past 20 years. This needs urgent research and the issue over GM food will also need to be revisited as new GM strains are much less susceptible and hence can improve yieldability of land and reduce price in the region. The role of science and engineering cannot be underestimated when it comes to the continued and future supply of food to the developing world.

We now have an unprecedented opportunity to improve the lives of billions of people through the sensible application of science and technology, with the potential of a stable world population in the second half this century.

The key to sustainable development is that it should not rely indefinitely on foreign aid. We need to move the agenda on from foreign aid as a handout to foreign aid as a means to achieving sustainable economic development. Part of this is a purely physical matter: a question of civil engineering. The business and the finance communities in African nations identify the lack of good roads, railways, air and water transport facilities, energy and water supplies, and telecommunications networks as some of the main considerations that hold back economic growth.

It is estimated that, to sustain a growth rate of 7% (which only three of the 16 sub-Saharan African countries achieve today), Africa needs to spend US\$20 billion more on this kind of infrastructure each year until 2015. A healthy infrastructure is vital for the success of new businesses, bearing critically on their profitability and competitiveness and therefore determining the climate for entrepreneurship. Such an infrastructure might be planned and built with foreign aid and expertise but it can only be maintained and renewed, and therefore make a long-term difference, by a local skilled workforce.

Developing a reliable and effective infrastructure is not just a matter of engineering. The issue is much more to do with building a physical, cultural and political framework within which science, engineering, agriculture, medicine, technology and innovation can be nurtured, taught and practiced.

Science and technology have too often been viewed as elitist luxuries only necessary for developing countries once poverty has been eradicated. They are in fact essential priorities.

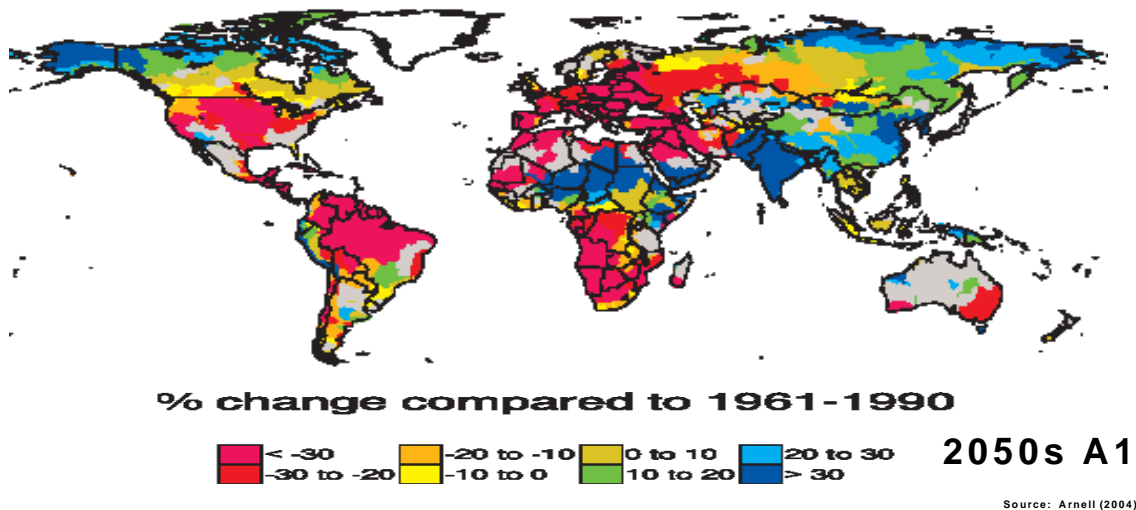
This should be apparent from some of the major problems afflicting the continent today. In sub-Saharan Africa, the incidence of HIV in 2003 was over 7% of the adult population and up to 90% of those with HIV are aged 15-49, representing the most productive section of the work force, which means that in some countries, projections indicate that 20-40% of this work force could be lost to AIDS.

Quite aside from its enormous social cost, this depletion has strong economic impacts too. Agricultural yields are reduced when there are insufficient farm workers to collect the harvest, and it is estimated that the economies of countries with a high incidence of AIDS may in 20 years' time have grown by only a third of what they would have done otherwise. And producing a well-educated cadre of engineers and technologists is constrained by such a high mortality rate and low life expectancy (typically 40-55 in sub-Saharan Africa).

Water will become an increasingly scarce resource in Africa, even though parts of equatorial Africa have a relatively high rainfall. Agriculture presents the biggest demand on available water sources – up to 80% in some developing countries – while industrialization creates new demands, and also new sources of pollution. Efficient irrigation methods can be relatively costly and labour-intensive to install and maintain. It is estimated that the rising per capita demand for water globally will exceed the available sources around 2050; in Africa, water shortages and contamination are already a major problem. Around 80% of all diseases, and a third of all deaths, in developing countries are the result of contaminated water. As the International Panel on Climate Change stated, Africa is the most vulnerable region in the world to climate change, due to the extremes of poverty, frequent natural disasters such as droughts and floods, and agricultural systems heavily dependent on rainfall. [See figure 4]

Figure 4

Warming will lead to major changes in water availability across the globe, with consequences for droughts and floods



In the UK, the Defra-funded UK Climate Impacts Programme (UKCIP) 2002 Scenarios suggest that average annual temperatures may rise by between 2 and 3 deg C by the 2080s. The seasonal distribution of precipitation will change, with winters becoming wetter and summers drier across much of the UK and especially in the south and east. Extreme high summer temperatures and heat waves and winter precipitation events are likely to become more frequent.

For Africa, with some of the largest population increases projected by 2050, there is a wide consensus that climate change will worsen food security, accelerate irreversible losses of biodiversity and have negative impacts on human health. One study suggests Africa could lose more than 4% of its GDP with just a 1 deg C increase in average global temperature.

In India, changes to the climate will affect a wide variety of ecosystems and socio-economic sectors with corresponding impacts on water resources, agriculture, forestry and other sectors. According to recent research, annual river runoff may decline up to 70% and cereal yields may decline up to 20%, and it is also expected that a sea-level rise of 1 m could displace 7 million

people.

In China, by the end of this century, average temperature increase may be between 3 to 4 deg C, crop yields (rice, maize and wheat) could fall by up to 37%, and large scale shrinkage of permafrost in northeast China is likely to occur leading to ground subsidence and loss of ecosystems/biodiversity.

Increases in sea-level and the intensity of tropical cyclones will displace many millions of people in low-lying coastal areas of temperate and tropical Asia; for example, for Bangladesh, a 1 m rise in sea level would result in over a fifth of the viable land area being lost and over 13 million people being put at risk.

Sea level rise of the magnitude currently projected is expected to have disproportionately large effects on the economic and social development of many small island states. In extreme circumstances, sea level rise and its associated consequences (for example, land loss and salinity intrusion to freshwater supplies) could trigger abandonment and significant 'off-island migration' at great economic and social cost.

Some of the impacts of climate change can be diminished by implementing adaptation measures such as improving coastal defences. Adaptation is extremely important as we are already locked into a degree of climate change. At the same time, we need to reduce global emissions of greenhouse gases in order to stabilise them at a level that avoids the 'dangerous' impacts of climate change.

There are likely to be significant biological impacts associated with population increase and climate change. The WWF Living Planet Index is one of the first attempts at producing a global-level indicator of trends in species populations. It is based on a relatively small number (c. 700) of vertebrate species for which data is available in forest, marine and freshwater ecosystems. The index declined rapidly from 1970 - 2000 – fewer data are available 1995 - 2000. The Convention on Biodiversity (CBD) is currently developing a set of global indicators to assess progress towards the World Summit on Sustainable Development (WSSD) target of significantly reducing the rate of biodiversity loss by 2010.

According to the CBD the main reasons for the decline in biodiversity are habitat destruction, over-exploitation, impacts of invasive alien species,

pollution and climate change. Climate change is currently bottom of the list of global threats. However this is likely to increase in significance as an impact, both because of its direct impact on species and because of its effect on the other causes of biodiversity loss, such as agricultural land use change, desertification and invasive alien species – this is an area for further investigation.

The developing world does need to nurture a holistic approach to education and research in order to address many of the social and technological problems it faces. Most of these stem not from a lack of technical solutions (AIDS and malaria are exceptions; waterborne diseases are mostly in principle readily preventable), but from lack of resources to implement them. Sound civil engineering, good sewage treatment and watershed management, quality hospital care, reliable energy sources – all these requirements are routinely met in developed countries, but they require a technically able work force for both implementation and maintenance that will not exist without investment in basic education. Africa for example needs mostly general practitioners, although high-level experts are certainly needed at the level of policy formulation and implementation. It does need centres of excellence - as with the IIT's in India –that can pull through the standards of skill development throughout the educational sector. And these centres will be capable of adapting modern science and technology developments to the particular needs of their own societies.

Some of the technological advances we have seen during the past several decades, such as cleaner manufacturing methods and waste recycling, solar power and energy-efficient machinery and devices might be valuable in helping Africa to leapfrog the eras of environmental degradation that Western countries have passed through, and which rapidly developing countries such as China now seem to have entered.

These new technologies might also sometimes better address the particular needs of African communities, for example by providing power supplies to remote villages that cannot be connected to a national grid, or by using information technology (tailored to particular cultural requirements) to put local users in direct contact with experts who can answer their questions. But development agencies have found that even relatively simple technologies cannot be introduced in a sustainable way without the infrastructure needed to support them. It is now recognized that the lack of trained people and suitable infrastructures (such as the supply of spare parts) obstruct the objectives of technology transfer from developed to developing nations.

Under-investment in science and technology means that indigenous research suffers from a brain drain (there are currently more African scientists and engineers working in the USA than in Africa), leading to continuous weakening of the secondary and tertiary education system. This then does not produce a population able to understand or exploit, let alone produce, new ideas and technologies.

If we are going to see sustainable and self-sufficient societies, in Africa, they need to be given the opportunity and motivation to work at a high level, in collaboration with the rest of the international community to address the problems outlined in this paper. The recent adoption of the AU/NEPAD Consolidated Plan of Action for Africa's Science and Technology is an important milestone in the effort to address this because it sets out a clear framework for coordinated, long term partnerships between African and donor countries and agencies.

The challenge is clear. Science, modern medicine and technology have, since the industrial revolution provided us with societies in which we can live longer healthier lives than in the pre-industrial period. Recognizing the importance of the population factor, now we need to use our wealth and technology to manage our economies within finite natural resources.

Sir David King

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