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World population

The end of growth is improbable

The global population may not stabilize at a level of 10 billion, as projections by the United Nations suggest

Rostock, Germany. UN projections suggesting that the world population will stop growing after reaching a level of 10 billion people at the end of this century are improbable. While there could be stagnation over the short term, even small fluctuations in the energy or food supply could cause the population size to deviate from the 10-billion mark, and enter another period of strong growth. This finding comes from model calculations performed by Oskar Burger at the Max Planck Institute for Demographic Research (MPIDR) in Rostock together with John DeLong from Yale University in New Haven, USA, and Marcus Hamilton from the Santa Fe Institute in Santa Fe, USA.

“The upper limit suggested by the United Nations hardly represents a stable equilibrium,” Oskar Burger said. The results of the team’s model have now been published in the science magazine “Frontiers in Ecology and the Environment”. The model is based on the observation that population growth strongly depends on per capita energy use: if more energy is available, economic development will continue, which will in turn put pressure on birth rates. If birth rates are sufficiently low throughout the world, the global population will stop growing. Burger’s model is thus at variance with the projections of the United Nations, which simply extrapolates a trend towards declining numbers of birth observed over the past several decades.

Zero growth is possible, but it will not last

“At a level of 10 billion people, zero growth is indeed within reach,” Oskar Burger said. “But the population size will remain at this level only if sufficient energy per capita remains constantly available.” But that can hardly be expected. “Since 1960, the population has been growing faster than the amount of usable energy worldwide,” Burger said. Thus, on average, the amount of energy available per person has been decreasing, and this trend is continuing.

“In the last 50 years the world population has actually moved farther away from reaching a stable equilibrium,” the MPIDR researcher said. If zero population growth does in fact occur at a level of 10 billion people, but there is an insufficient supply of energy, it could only take a very small change in the resources or in the behavior of societies to trigger a deviation from this trend, which could gain momentum very quickly.

"Of course our model of population growth is very simple," Oskar Burger said. It is not intended to replace the existing UN projections or using it to make concrete forecasts. But it is a starting point for including more dynamics in population models by taking into account the very fundamental dependence on energy as a first step. This is a jumping off point to learn more about how energy specifically links to population size, Burger said.

Population models need to be based on causal factors

Even if the relationship between energy and population growth were to change, the stability of the population size at the 10-billion level is not guaranteed, Burger stressed. "The main problem with the UN approach is that stability analyses of the projected equilibrium, the point of zero growth, are not possible. Stability analysis requires a dynamic rather than a purely statistical model." This is because it is not sufficient for such analyses to base their projections of population size on the amount of time elapsed, without taking into account other causal factors. Especially, the UN projections assume total independence from energy resources.

Instead, researchers need to develop a dynamic model of the global population in which projections are based at least on energy availability and possibly on other parameters such as natural resources, the economy, and cultural and political influences. Only after conducting analyses using such models can we predict more accurately whether there is in fact a stable upper limit to population growth, and determine how we can move towards it.

About the MPIDR

The Max Planck Institute for Demographic Research in Rostock (MPIDR) investigates the structure and dynamics of populations. It focuses on issues of political relevance such as demographic change, aging, fertility, the redistribution of work over the course of life, as well as aspects of evolutionary biology and medicine. The MPIDR is one of the largest demographic research bodies in Europe and one of the worldwide leaders in the field. It is part of the Max Planck Society, the internationally renowned German Research Society.

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