

Transgressing Planetary Boundaries

Challenges of population control and food production need to be tackled in tandem

BY JEFFREY D. SACHS



We are eating ourselves out of house and home. Recently, in the September 24 issue of *Nature*, Johan Rockström and his colleagues proposed 10 “planetary boundaries” to define safe limits of human activity. (*Scientific American* is part of the Nature Publishing Group.) Those limits include caps on greenhouse gas emissions, biodiversity loss, the global conversion of land cover to cropland, and other mega-impacts on the earth’s ecosystems. Yet humanity has already exceeded several of them and is on a trajectory to exceed most of the others. The rising demand for food plays a large role in those transgressions.

The green revolution that made grain production soar gave humanity some breathing space, but the continuing rise in population and demand for meat production is exhausting that buffer. The father of the green revolution, Norman Borlaug, who passed away in September at the age of 95, made exactly this point in 1970 when he accepted the Nobel Peace Prize: “There can be no permanent progress in the battle against hunger until the agencies that fight for increased food production and those that fight for population control unite in a common effort.”

That common effort was inconsistent at best and sometimes essentially nonexistent. Since 1970 the population has risen from 3.7 billion to 6.9 billion and continues to increase by around 80 million a year. Food production per person has declined in some big regions, notably sub-Saharan Africa. In India the doubling of population has absorbed almost all of the increase in grain production.

Food production accounts for a third of all greenhouse gas emissions when one tallies those from fossil fuels used in growing, preparing and transporting food; the carbon dioxide released by clearing land for farming and pastures; the methane from rice paddies and ruminant livestock; and the nitrous oxide from fertilizer use.

Through the clearing of forestland, food production is also responsible for much of the loss of biodiversity. Chemical fertilizers cause massive depositions of nitrogen and phosphorus, which now destroy estuaries in hundreds of river systems and threaten ocean chemistry. Roughly 70 percent of worldwide water use goes to food

production, which is implicated in groundwater depletion and ecologically destructive freshwater consumption from California to the Indo-Gangetic Plain to Central Asia to northern China.

The green revolution, in short, has not negated the dangerous side effects of a burgeoning human population, which are bound to increase as the population exceeds seven billion around 2012 and continues to grow as forecast toward nine billion by 2046. Meat consumption per capita is rising as well. Beef poses the biggest threat because cattle require up to 16 kilograms of feed grains for each kilogram of consumed meat, they emit large amounts of methane, and the fertilizer used to grow their feed contributes hugely to nitrogen oxides.

It is not enough to produce more food; we must also simultaneously stabilize the global population and reduce the ecological consequences of food production—a triple challenge. A rapid voluntary reduction in fertility rates in the poor countries,

brought about by more access to family planning, higher child survival and education for girls, could stabilize the population at around eight billion by 2050.

Payments to poor communities to resist deforestation could save species habitats. No-till farming and other methods can preserve soils and biodiversity. More efficient fertilizer use can reduce the transport of excessive nitrogen and phosphorus. Better irrigation and seed varieties can conserve water and reduce other ecological pressures. And a diet shifted away from eating beef would conserve ecosystems while improving human health.

Those changes will require a tremendous public-private effort that is yet to be mobilized. As we remember Borlaug’s great achievements, we must redouble our efforts to

respond to his admonitions as well. The window of opportunity to achieve sustainable development is closing. ■

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