

The Sahel: A Malthusian Challenge?

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1 **Abstract** The population of the least developed countries of the Sahel will more than triple
2 from 100 million to 340 million by 2050, and new research projects that today's extreme
3 temperatures will become the norm by mid-century. The region is characterized by poverty,
4 illiteracy, weak infrastructure, failed states, widespread conflict, and an abysmal status of
5 women. Scenarios beyond 2050 demonstrate that, without urgent and significant action today,
6 the Sahel could become the first part of planet earth that suffers large-scale starvation and
7 escalating conflict as a growing human population outruns diminishing natural resources.
8 National governments and the international community can do a great deal to ameliorate
9 this unfolding disaster if they put in place immediate policies and investments to help com-
10 munities adapt to climate change, make family planning realistically available, and improve
11 the status of girls and women. Implementing evidence-based action now will be an order of
12 magnitude more humane and cost-effective than confronting disaster later. However, action
13 will challenge some long held development paradigms of economists, demographers, and
14 humanitarian organizations. If the crisis unfolding in the Sahel can help bridge the current
15 intellectual chasm between the economic commitment to seemingly endless growth and the
16 threat seen by some biologists and ecologists that human activity is bringing about irreversible
17 damage to the biosphere, then it may be possible also to begin to solve this same formidable
18 problem at a global level.

19 1 Introduction

20 In 1798 Thomas Malthus famously said,

21 “I think I may fairly make two postulata

22 First, that food is necessary to the existence of man.

23 Secondly, that the passion between the sexes is necessary and will remain nearly in its
24 present state” (Malthus 1798).

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25 Since the end of World War II, the human population has tripled in less than a single human
 26 lifetime—something that has never happened before and will never happen again. Over the
 27 same period, industrial production has increased eightfold. The world as a whole has been
 28 remarkably successful in keeping up with this unprecedented pace of change (Potts 2009).
 29 But continuing rapid population growth in certain parts of the world, especially in regions
 30 likely to suffer from severe climate change, and where food supplies will diminish, could
 31 force us to look again at the conclusion Malthus reached in 1798,

32 “The power of population is so superior to the power of the earth to produce subsistence
 33 for man, that premature death must in some shape or other visit the human race”
 34 (Malthus 1798).

35 Most scientists use past history as a foundation for projecting future events, although they
 36 sometimes come to opposite conclusions. Building on past patterns, many demographers see
 37 population as stabilizing. Most economists and practically all politicians, building on the past
 38 60 years of economic history, assume that the global economy will, and should, continue to
 39 grow. The global economy is estimated to have been \$38 trillion in 2000 and it is suggested
 40 it could reach \$206 trillion in 2050 (Vision 2050 Report, 2013). David Lam, an economist
 41 who gave the 2011 Population Association of America address, concluded, “I expect that [the
 42 world] will have improved in many ways, including lower poverty, higher levels of education,
 43 and plenty of food to go around” (Lam 2011). Many biologists, climatologists and ecologists
 44 hold the opposite view, expecting current levels of human consumption, particularly of energy,
 45 to exceed the capacity of the biosphere to supply enough food or absorb carbon dioxide waste
 46 (Millennium Ecosystem Assessment 2005). Many biologists see insurmountable barriers to
 47 continued economic growth and judge a \$206 trillion global economy as unequivocally
 48 unsustainable (The Royal Society 2012).

49 In 1972, *The Limits of Growth* stated, “The basic behavior mode of the world system is
 50 exponential growth population and capital, followed by collapse” (Meadows et al. 1972).
 51 Forty years later, with more data and after considerable additional growth in population and
 52 industry, Paul and Anne Ehrlich returned to the same theme suggesting “global collapse
 53 seems likely” (Ehrlich and Ehrlich 2013). The next 60 years, according to biologists, will be
 54 somewhat different from the past. This chasm between the intellectual paradigm of econo-
 55 mists and many demographers, and the ecologists, biologists, and some physical scientists,
 56 is surprising and dangerous. Analyses of projections and possible evidence-based solutions
 57 to population and climate change in the Sahel over the rest of this century will test whether
 58 this chasm can be bridged.

59 2 The Challenge

60 The 2012 Working Group of the Royal Society, *People and the Planet*, recommended “Pop-
 61 ulation and the environment should not be considered as two separate issues” (The Royal
 62 Society 2012). It is a particularly apt recommendation for the Sahel, where the uniquely high
 63 population growth rate is going to collide with the impacts of climate change, threatening a
 64 major humanitarian disaster.

65 The Sahel is sometimes equated with the Francophone countries that comprise West
 66 Africa. In our analysis, however, we are using an ecological definition encompassing over
 67 one million square miles of arid and semi-arid land stretching from the Atlantic coast to the
 68 Red Sea.

In 1950, the population of the countries in this region totaled 30 million. Today, the Sahel is home to approximately 100 million of the poorest, most disempowered and forgotten people in the world. Pastoralists and subsistence farmers live in a drought stricken and famine prone area. The countries of the region are on the bottom rungs of the Human Development Index. Illiteracy and poverty are pervasive, child marriages are common, and the status of women is particularly low. Some countries, such as Chad, are amongst the most corrupt in the world (World Bank 2012). Already today, 12–18 million people in this region are hungry (OXFAM 2012). In 2012, jihadists, such as *Ansar Din* and al-Qaeda clones took over half of Mali, an area equal to the size of France. Although the jihadist groups have been driven from most cities, violence remains near the surface (Oumar 2013).

2.1 Climate

The Western Sahara has a monsoon climate that carries moisture from the Atlantic eastward across the African continent. Since 1950, the climate of the region has experienced increasing variability, probably driven in part by the increase in atmospheric particulates drifting across the Atlantic from the industrialized regions in North America. After 1950, there was an overall increase in precipitation, but between 1970 and the early-1990s, there were severe droughts. Since 1993, there have been further changes, including some very wet years and very dry years (Ward 1998). New studies predict that the Sahel will be 3–5°C warmer by 2050 (Potts et al. 2013). To give a sense of scale, it is estimated that a rise of 5°C is all that separates today's world from the last Ice Age. Extreme weather events are predicted to become more common. Precipitation may increase, but it could be so hot that the water will evaporate before it reaches plant roots. The rain that does occur is increasingly likely to come as flash floods that wash crops away. By 2100, it is projected that the mean temperatures in countries such as Niger could increase by 5–8°C (Potts et al. 2013).

Based on the history of the past two decades, the possibility of the Sahel feeding itself or providing alternative employment for another 100 million people by mid-century is remote. The 2007 *Inter-governmental Panel on Climate Change* pointed out that in much of Africa, food production will "be severely compromised" by climate change and will "further adversely affect food security and exacerbate malnutrition" (IPCC 2007).

2.2 Population

The 1994 International Conference on Population and Development (ICPD) in Cairo set out two complementary goals: an emphasis on individual rights and choice in family planning, and the obligation to invest in family planning with the objective of slowing rapid population growth, especially in Africa. Unfortunately, instead of following the agreed Programme of Action (PoA), some advocacy groups framed attention to population in pejorative terms and the subject was pushed off the international agenda for 20 years (Campbell 2007). Budgetary support for international family planning collapsed (Spiedel et al. 2009). Between 1997 and 2007, the World Bank devoted only four percent of its funds to family planning. An independent evaluation group concluded that, "support for population nearly disappeared" (World Bank 2009). International organizations such as the United Nations Population Fund (UNFPA) and International Planned Parenthood Federation (IPPF) embraced a wide range of goals that were considerably different from their own origins. For example, in 2011 with a total income of just over \$120 million, IPPF spent \$47 million on "non-contraceptive services," including \$15.1 million on HIV/AIDS (IPPF 2012). Unfortunately, in low-resource settings, adopting too many goals can dilute efforts to make family planning choices easily accessible.

114 As a result of the loss of focus on family planning since the ICPD, the decline in birth rates,
 115 which had begun in parts of Africa before 1994, stalled (Ezeh et al. 2009). This led to
 116 the development of a great deal of demographic momentum and undermined the powerful
 117 contribution that the adoption of family planning could have led to in reducing maternal and
 118 infant mortality (Diamond-Smith and Potts 2011; Rutstein 2005).

119 The UN Population Division's medium variant projections show that the population of
 120 the Sahel will reach 340 million by 2050 and 600 million by 2100 (UN Population Division
 121 2012). The 2050 figure is likely to be unsustainable; the 2100 projection is certain to be
 122 unsustainable. There is a possibility that if vigorous efforts are made immediately, the unmet
 123 need for family planning in the area could be filled. The international community will also
 124 need to keep pace with the escalating need for humanitarian assistance in this region. With
 125 such activities, it may be possible to reduce the threat of rising death rates and increasing
 126 political instability posed by such a high rate of population growth. However, adapting to
 127 massive population growth and climate change at the same time seems extremely unlikely.

128 In 2009, Adair Turner stated, "... how Niger is going to feed a population growing from
 129 11 million today to 50 million in 2050 in a semi-arid country which may face adverse climate
 130 change is unclear" (Turner 2009). Four years later, the population of this one country has
 131 grown to over 17 million (Potts et al. 2011). The new Demographic and Health Survey (DHS)
 132 found that the Total Fertility Rate (TFR), defined as the average number of children 1,000
 133 women will have in a fertile lifetime, was 7.6 children per woman, the highest birth rate
 134 in the world. An earlier estimate of 7.1 children proved unduly optimistic. Despite some
 135 recent changes in the commitments to family planning by the government of Niger, the
 136 Contraceptive Prevalence Rate (CPR), defined as the proportion of women of reproductive
 137 age who are using (or whose partner is using) a contraceptive method at a given point in time,
 138 is only 11 % for modern contraceptives. The CPR has increased by just over two points per
 139 year since the last DHS in 2006. The new goal of the Nigerien government is to reach the
 140 unprecedented goal of a 25 % CPR by 2015. In Chad, the CPR is increasing by a mere 0.05
 141 additional points each year (Guengant 2012). Significant policy changes and considerable
 142 investment will be needed to shift the population projections of the Sahel to a trajectory
 143 that might permit sustainable growth in the population. Unfortunately, the threat of climate
 144 change makes a difficult problem doubly difficult to solve.

145 2.3 After 2050

146 Climate and population projections to the second half of the twenty-first century entail more
 147 uncertainty than near term forecasts, but they are still scientifically possible and useful.
 148 Demographic changes take place over generations. Some of those who will still be in their
 149 fertile years in mid-century are already born. The demographic momentum that has been
 150 built up in the past 20 years cannot be reversed—unless, of course, death rates rise. The
 151 uncertainties that exist are not so much whether serious adverse population and climate
 152 changes will occur, but exactly when these adverse changes will take place. Crops that
 153 are exposed to temperatures of 29°C or more for any length of time see yields plummet
 154 dramatically (Schlenker and Roberts 2009). What is certain is that under 'business as usual'
 155 scenarios for population growth in the Sahel, and for continued levels of greenhouse gas
 156 emissions from industrialized nations, climate change will destroy crops and kill livestock.

157 Under these circumstances, the region is likely to see massive migration and possibly
 158 more conflict. The combination of rapid population growth and a particularly severe impact
 159 of climate change imply pain and misery for many tens of millions of people, resulting in
 160 a burden on neighboring countries of an increasing number of ecological refugees. This

161 situation is likely to escalate political instability that will prove costly far outside the region.
 162 Even in 2011, long before the huge increases in population and temperature that scientific
 163 analysis projects, food aid to the Sahel cost over \$900 million. Considering Somali piracy as
 164 an increased cost of trade translates into an estimated US \$18 billion yearly loss to the world
 165 economy (The World Bank 2013). Al-Qaeda leaders call Mali, Chad, Mauritania, Libya
 166 and Niger, "The Great Islamic Desert." European researchers in the Monitoring Centre for
 167 Organised Crime estimate that there are between 8,000 and 14,000 members of al-Qaeda in
 168 training camps, and these represent a greater threat than the al-Qaeda presence in Afghanistan
 169 (European Monitoring Center for Organised Crime 2013). In the mid-twenty-first century
 170 and beyond, when there are two or even four times as many uneducated, unemployed, volatile
 171 young men in the region, the situation will be even more challenging.

172 3 Are There Solutions?

173 Can scientific innovation avert what analysis suggests in an inevitable and large-scale dis-
 174 aster? Almost 200 years ago, Friedrich Engels refuted Malthus' dismal prognostications by
 175 maintaining that scientific "progress is as unlimited and at least as rapid as that of popula-
 176 tion" (Engels 1844). The progress of science-based industry and science-based agriculture
 177 has indeed gone a long way towards substantiating this criticism of *An Essay on the Principle*
 178 *of Population*. In the case of agriculture, a heavier use of fertilizer and pesticides and better
 179 quality seeds might triple crop yields. Modern irrigation methods could further increase out-
 180 put. In coming decades, genetic engineering might improve the yield and/or the resistance to
 181 plant pests of African staples, such as sorghum. But all these solutions take time and money,
 182 and neither is available in generous amounts in the Sahel. Moreover, the scale of climate
 183 change projected for the second half of this century seem likely to overwhelm any plausible
 184 improvements in crop yields.

185 Switching to large scale, mechanized agriculture might be more cost-effective, but it
 186 would have to be introduced carefully to avoid displacing small sharecroppers who comprise
 187 the majority of farmers. Real progress will be made if farmers are given access to more
 188 transparent, just markets and insurance against poor harvests is made available. Perhaps
 189 information about when to plant, and about market prices, can be disseminated over cell
 190 phones. Small irrigation projects to store sudden downpours and drip irrigation are appropriate
 191 technologies, and the Sahel is the best place in the world to develop small solar powered
 192 electrical systems. However, given the poor governance and increasing violence in the region,
 193 will such best practices get implemented?

194 No significant long-term progress in the Sahel will be possible without improving the
 195 status of women. Over considerable parts of the Sahel, women do much of the agricultural
 196 work, by providing labor in the fields and caring for animals. The Sahel has the disadvantage
 197 of child marriage, polygamy, and the brutality of widespread female genital mutilation—
 198 symbols of a patriarchal society where few women are empowered to make choices about
 199 marriage or managing their childbearing. Lack of investment in women's education, inap-
 200 propriate medical policies, and an absence of comprehensive abortion care have made a
 201 difficult situation worse. Over the past 15 years in Northern Ghana, the Navrongo Project
 202 has explored the impact of offering modern family planning in a remote region with the
 203 culture and ecology of the Sahel. In one quasi-experimental area, where nurses distributed
 204 contraceptives and there were social mobilization activities for men, the TFR fell from 5 in
 205 1995 to 3.6 in 2010 (Phillips et al. 2012). Unfortunately, the contraceptive distribution system
 206 was over-medicalised, following inappropriate protocols such as requiring nurses to take a

207 woman's blood pressure before using oral contraceptives. The three-month injectable con-
 208 traceptive proved the most popular method among family planning clients, but distribution
 209 of this method was also limited to nurses, which unnecessarily constrained its availability.

210 Other countries in sub-Saharan Africa are making important progress and the Sahel could
 211 do better, provided the international community has the will to make needed investments
 212 and policy changes. Malawi made family planning illegal until 1984, but by 2010, 42.2 % of
 213 women were using modern contraception. Rwanda, through providing robust family planning
 214 programs, has gone from a CPR of 6 % in 2000 to 45 % in 2010 (Zulu 2012).

215 If the Sahel is to avoid a Malthusian disaster it will be made possible by adopting evidence-
 216 based solutions to slow population growth and give women more autonomy. To do so will
 217 require looking at old problems in new ways.

218 4 Paradigms, Ideology and Evidence

219 As observed earlier, when building future scenarios pertaining to complex issues, scientists
 220 are sometimes tempted to extrapolate from past experience stretching back 100 or 200 years.
 221 We suggest that in the case of demography and economics, the past may not always be a
 222 good predictor of the future.

223 4.1 Demography

224 The classical theory of the demographic transition put forward by Frank Notestein, Kingsley
 225 Davis and others in the middle of the twentieth century has continued to have considerable
 226 influence on demographic and economic thinking, even though this paradigm, based on
 227 extrapolations from the European countries' demographic transition, has proved to have
 228 limited predictive value in today's world. The theory holds that death rates fall before birth
 229 rates, leading to a growth in population until a new equilibrium is established when low death
 230 rates are matched by low birth rates. It assumed that these changes were driven primarily
 231 by improvements in wealth and education. The classical theory was used to criticise the
 232 launch of family planning programs established in the second half of the twentieth century
 233 (Davis 1967). However, many of these programs ultimately proved highly successful. It did
 234 not predict or explain below replacement fertility in industrialized nations. In *Population*
 235 *and Development: the Demographic Transition*, Dyson sees a transition as, "self-contained
 236 and inexorable over the long run" (Dyson 2010). The US National Academy of Sciences
 237 panel in 2000 concluded, "fertility in countries that now have not completed the transition
 238 should eventually reach levels similar to those now observed in low fertility countries."
 239 (Bongaarts and Bulatao 2000) Wolfgang Lutz, editing a recent volume called *The End of*
 240 *World Population Growth in the twenty-first Century* writes,

241 "...the well founded, general notion of demographic transition is the basis of our
 242 expectation that world population growth will come to an end during the second half
 243 of the twenty-first century" (Lutz et al. 2001).

244 But, even taking the Lutz assumption that all countries will drift inexorably towards 2.1
 245 children, the UN Population Division projects that the least developed countries (those with
 246 a current a TFR of 3 to over 7) will be the largest single population group in 2100—between
 247 2.8 billion in the low population variant and 6.1 billion in the high variant.

248 We suggest that the classical demographic transition theory has outlived its usefulness
 249 (Campbell et al. 2013). As Szreter comments,

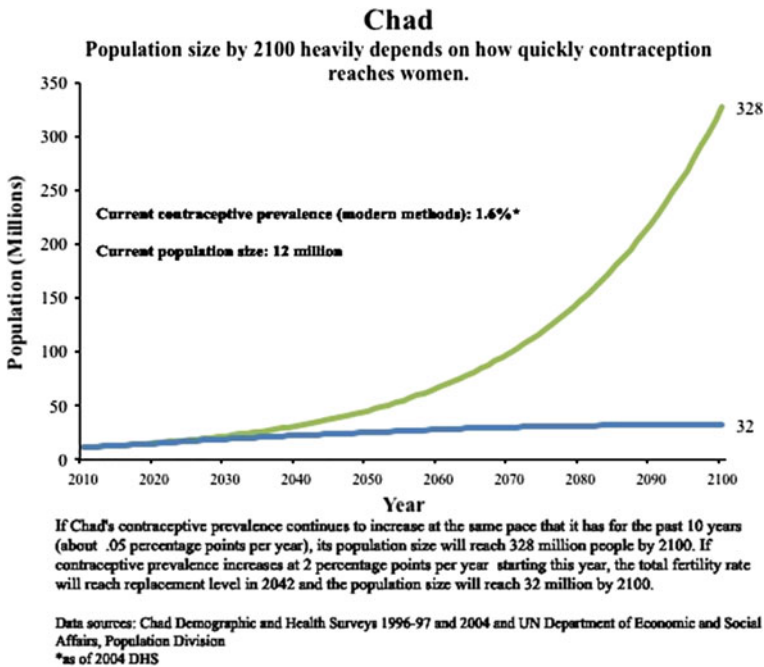


Fig. 1 The rate at which contraceptive prevalence increases determines the final population size: the example of Chad

250 “the [demographic] model’s conceptual structure was allowed to become so general
251 and the theoretical relations so flexible that, as a causal explanation of change, it became
252 an empirically irrefutable theory” (Sztejer 1993).

253 If we are correct in arguing that there is little or no empirical evidence to support the assumption
254 on which the UN Population Division makes its predictions that the least developed
255 countries will reach, or come close to, 2.1 children by 2100, then the situation in the Sahel
256 becomes even more challenging. For example, only 1.6% of women in Chad use modern
257 methods of contraception. The CPR increased by only an additional 0.05% per year between
258 1996–1997 and 2010 (Guengant 2012). Unless there are major changes, the population will
259 reach unsustainable numbers and still be growing rapidly in 2100 (see Fig. 1). If, however,
260 Chad increased the CPR by an additional 2% each year, then the population would still
261 almost triple before it stabilized late in the century.

262 Population projections based on careless assumptions mislead policymakers. The recent
263 efforts of the UN Population Division to publish probabilistic population projections using a
264 Bayesian Hierarchical Model (BHM) is particularly deceptive if, as we suggest, assumptions
265 such as Dyson’s that the demographic transition is, “self-contained and inexorable over the
266 long run” are incorrect. For example, Niger’s upward revision from a TFR of 7.1 to 7.6
267 made in the 2012 DHS has already partly undermined the BHM projections published only
268 a few months earlier. The UN Population Division country profile for Chad projects life
269 expectancy at birth to rise from 50 years for women in 2000 to 77 years in 2100. As Chad’s
270 under-5 mortality has actually risen in the early twenty-first century, and as Chad has no
271 achievable way of supporting over 64 million people, let alone 290 million, the data coming
272 out of countries such as Chad strongly suggests that death rates are likely to begin to rise

273 long before fertility declines substantially. The need is for projections based on the recent
 274 history of changes in the CPR—projections that might stimulate domestic leaders to place
 275 more emphasis on removing the non-evidence based barriers that often prevent women from
 276 using modern contraception (Campbell et al. 2006).

277 4.2 Economics

278 Herb Stein, senior fellow at the American Enterprise Institute and economic advisor to Nixon
 279 and Ford, once said about trends that run into finite barriers, “If something cannot go on
 280 forever, it will stop” (Stein 1999). In general, economists discussing fertility decline have
 281 given greater weight to distal factors, such as wealth and education, than to the alternative
 282 hypotheses that access to family planning can drive fertility decline, even in poor, illiterate
 283 societies (Campbell et al. 2013). For example, in *The End of Poverty*, Jeffrey Sachs writes,

284 “One reason for the poverty trap is the demographic trap, where impoverished families
 285 choose to have lots of children.” “. . . Because the parents are risk averse, and want
 286 to assure with a high probability of the least one child. . . they overcompensate in a
 287 statistical sense” (Sachs 2005).

288 It might be useful to return to Malthus’s second postulate—that, “the passion between the
 289 sexes is necessary and will remain nearly in its present state.” The flaw in Sachs’ argument is
 290 not that “impoverished families” necessarily want “lots of children”, but that they do not have
 291 the knowledge or means to separate “the passion between the sexes” from another unintended
 292 pregnancy. In patriarchal societies, such as most of those in the Sahel, a wife cannot refuse
 293 her husband’s sexual demands, and a large family is the default situation. Malthus got it right:
 294 this reality is a simple concept but all too often overlooked.

295 The need is to understand the problems facing women in male dominated societies who
 296 want to separate child bearing from the “passion between the sexes.” In the Navrongo study
 297 in Ghana, which was quoted earlier, 56% of women surveyed wished to keep the use of
 298 contraception secret from their husbands and neighbours. The mistake in Navrongo was
 299 to force women to go to a nurse in order to receive an injectable contraceptive. The more
 300 productive approach is to train community volunteers over only a few days to dispense
 301 injectable contraceptives in the privacy of the woman or the volunteer’s home, as has been
 302 done safely and effectively in Ethiopia (Prata et al. 2011).

303 Finally, if the Sachs contention that, “impoverished families choose to have lots of chil-
 304 dren”, unless individuals get richer and better educated is correct, then another serious prob-
 305 lem arises. According to May, no country, with the exception of some anomalous oil-rich
 306 states, with a TFR of 5 or over has developed (May 2012). If this is true, then the Sachs
 307 assumption implies that nothing is ever going to stop women in high fertility societies from
 308 having “lots of children.” It was this conundrum that seems to have forced Indian prime min-
 309 ister Indira Gandhi in 1975 to introduce financial incentives for adopting family planning—a
 310 policy that rapidly deteriorated into coercion. Gandhi’s policies caused the loss of her party’s
 311 1977 election. It seems reasonable to suggest that, as a result of the classical explanation of
 312 the demographic transition she had inherited, she saw no alternative to the politically difficult
 313 path she chose. Gandhi was caught by the dilemma that arises when economists and demog-
 314 raphers subscribe to the paradigm that improvements in socio-economic circumstances are
 315 a prerequisite to fertility decline. She wrote,

316 “It is clear that simply to wait for education and economic development to bring about
 317 a drop in fertility is not a practical solution. The very increase in population makes

318 economic development slow and more difficult of achievement. The time factor is
319 pressing and the population so formidable, that we have to get out of this vicious circle
320 through direct assault upon this problem . . . Where [an Indian] state legislature, in the
321 exercise of its own powers, decides that the time is right and it is necessary to pass
322 legislation for compulsory sterilization, it may do so” (Pearce 2010).

323 4.3 A Human Rights Framework

324 The hypothesis we suggest is that if the unjustified barriers to family planning are removed,
325 if family planning is demedicalised, if poor communities are empowered to help themselves,
326 if needed investments in contraceptive delivery systems are made, if the widespread misin-
327 formation about modern contraceptives are corrected, and if in societies with child marriage
328 an investment is made to keep girls in school and enable them to raise the age of their first
329 births, then the TFR will fall. If these things were done, then Chad might be in a position
330 to increase the CPR by an additional 2 percentage points every year over several decades
331 (Fig. 1). Unfortunately, there are a lot of ‘ifs’ in such a policy. We worry that not all decision
332 makers in countries with weak governance, little or no representation of women, and often
333 high rates of corruption, will adopt the policies urgently needed. We also recognize that the
334 international community, as represented by the World Bank and the African Development
335 Bank, may not respond rapidly enough to the imperative to place family planning center
336 stage. Humanitarian organizations such as UNICEF or UNHCR have either been timid in
337 recognizing the centrality of family planning, or more commonly, they have avoided the
338 subject all together.

339 Decision makers in large donor institutions such as USAID, DFID or the Bill and Melinda
340 Gates Foundation often work in silos. So, for example, USAID’s Feed the Future Initiative
341 makes no explicit reference to the simple fact that it is going to be impossible to feed 300
342 million people in the Sahel by 2050—and doubling again by 2100. The report published by
343 the *Commission on Sustainable Agriculture and Climate Change*, chaired by the UK Chief
344 Scientist Sir John Beddington, recognizes the challenge set by rapid population growth in
345 some regions, but it fails to take the next step of recognizing that such rapid growth can be
346 slowed within a human rights framework, and that investing in family planning should be an
347 intrinsic and essential part of any realistic set of policies to achieve food security.

348 5 Conclusion

349 Eighty percent of the world’s population is at or within striking distance of replacement level
350 fertility, and it is likely to remain at that level or below for the remainder of this century.
351 The other 20 % has between three and more than seven children, and there is no compelling
352 reason to assume that most of the least developed countries will reach replacement level
353 fertility by 2100. These high fertility counties include nations such as those in the Sahel,
354 Afghanistan, Yemen, and parts of Pakistan. Continued rapid population growth in these
355 regions has three important geopolitical implications. First, the current global divide between
356 rich and poor nations will get significantly worse. Second, much of this population growth
357 will be in least developed countries which are highly vulnerable to climate change, potentially
358 rolling back many of the public health achievements of the past 50 years. Third, we might
359 expect to see these high fertility, least developed countries become even more politically
360 unstable.

361 It needs to be understood that the rate at which population continues to grow in the least
 362 developed countries later in this century will be largely determined by decisions made before
 363 2020. Population growth is rather like a super tanker—it takes a long time to slow down.
 364 A good illustration of demographic momentum is Iran, where the TFR has fallen to 1.9 but
 365 there are still one million more births than deaths each year.

366 *People and the Planet* concludes, “On a finite planet there are environmental constraints
 367 on human population growth.” Later it concludes,

368 “The combined effects of market forces and new technologies are not able to overcome
 369 planetary boundaries on the scale necessary to avoid unsustainable pressure on the
 370 planet and much human suffering.”

371 Those boundaries are being reached in the Sahel. This is the region where the fabric of
 372 civilization, weakened by rapid population growth and stretched by climate change driven by
 373 bloated northern consumption, is likely to fail first. This is where death rates could begin to
 374 rise again. If a ‘business as usual’ policy and lack of investment continues, then the Sahel could
 375 prove the first region where, as Thomas Malthus wrote in 1798, “The power of population
 376 is so superior to the power of the earth to produce subsistence for man, that premature death
 377 must in some shape or other visit the human race.”

378 It is difficult to estimate the overall ability to increase energy and food production, but
 379 recent analysis suggests that human consumption may be approaching a finite boundary (Neff
 380 et al. 2011). In the case of food, there is a limit to the net primary plant production (NPP), the
 381 maximum photosynthetic production, which is possible on the planet. As Running writes,
 382 “It is not whether humans will reach the global NPP boundary but when they will do so”
 383 (Running 2012). The emerging economies are likely to continue to eat more animal protein,
 384 and a larger slice of the world’s available grain will be diverted to feeding livestock, or to
 385 ethanol to drive automobiles.

386 Rapid population growth in the Sahel is not because women are having more children
 387 than they did previously, but because more children are surviving to reproduce in the next
 388 generation. Rapid and unprecedented declines in death rates have been brought about by
 389 the introduction of science-based technologies such as vaccines, almost entirely funded by
 390 international agencies supported by northern governments and philanthropic institutions.
 391 Restoring a sustainable rate of population growth based on a falling birth rate instead of a
 392 rising death rate and unparalleled migration, as seems likely if a ‘business as usual’ scenario
 393 continues, will largely depend, as it has in the case of death rate decline, on policies and
 394 investments made by the international donor community. Lack of resources, endemic cor-
 395 ruption and cultural attitudes to polygamy, large families and lack of female autonomy make
 396 the generation and funding of domestic solutions improbable. Whether industrialized nations
 397 will take on the responsibility of limiting carbon production will depend to a considerable
 398 extent on whether the chasm between the economists and biologists can be bridged. If that
 399 chasm can be spanned, then perhaps global collapse can also be avoided. If huge numbers of
 400 thoughtful people with access to colossal amounts of data are unable to close this divide, then
 401 hundreds of millions of vulnerable people, most likely beginning in the Sahel, will suffer
 402 pain and misery. If this happens, it may also be that the possibility of solving even larger
 403 global problems will become even more remote.

404 The first determinant of the health, happiness and economic sustainability of the least
 405 developed countries—beginning with the Sahel—will be the timeliness with which the
 406 pledges that were made at the London Family Planning Summit held in July 2012 are fol-
 407 lowed up and implemented. Time is of the essence. Donors must learn to work in difficult,

sometimes dangerous regions in flexible, opportunistic ways. Carefully planned strategies that might work in a moderately stable country like Tanzania are unlikely to prove useful in Chad or Mali, where the infrastructure is weak, human capital is in short supply, and corruption widespread. The work that needs to be undertaken, especially the investment needed to improve the status of women will be in billions, not hundreds of millions, of dollars. But if this is not done, the cost of inaction will be much greater. The US federal government (2013) spends almost \$2 billion a day on defense, and bringing stability to a region such as the Sahel needs to be seen as a national security goal, as well as a humanitarian imperative. The second important determinant will be the ability—or lack of ability—of the industrialized nations and emerging economies to reign in the use of fossil fuels.

It would be satisfying to prove Malthus wrong once again, but the portents are not encouraging. It will take new thinking by economists, demographers, agriculturalists, many humanitarian organizations and a concerned public to avert a Malthusian catastrophe in the Sahel. If the unfolding crisis in the Sahel can help bridge the current intellectual chasm between the economic commitment to seemingly endless growth and the threat seen by some biologists and ecologists that human activity is bringing about irreversible damage to the biosphere, then it may be possible also to begin to solve this same formidable problem at a global level.

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