# Chapter 7
# Synergy between Population Policy, Climate Adaptation and Mitigation

**Jane N. O'Sullivan**

**Abstract** Global, national and regional population projections are embedded in projections of future greenhouse gas emissions and in the anticipated impacts of climate change on food and water security. However, few studies acknowledge population growth as a variable affecting outcomes. Neither the uncertainty around population projections nor the scope for interventions to moderate growth is discussed. Instead, a deterministic approach is taken, assuming that population growth is governed by economic and educational advances.

This chapter reviews the treatment of population in climate change scenarios and the prospects for proactive interventions to influence outcomes. Sensitivity analyses have demonstrated population to be a dominant determinant of emissions. The assumption that population growth is determined by economic and educational settings is not well supported in historical evidence. Indeed, economic advance has rarely been sustained where fertility remained above three children per woman. In contrast, population-focused voluntary family planning programmes have achieved rapid fertility decline, even in very poor communities, and enabled more rapid economic advance.

Policy-based projections of global population are presented, based on the historical course of nations that implemented effective voluntary family planning programmes. If remaining high-fertility nations adopted such programmes, global population could yet peak below 9 billion. Current trends make it more likely to exceed 13 billion people by 2100 unless regional population pressures cause catastrophic mortality rates from conflict and famine. Global support for family planning could reduce population by 15% by 2050 and 45% by 2100 compared with the current trend. Co-benefits include gender equity, child health and nutrition, economic advancement, environmental protection and conflict avoidance.

**Keywords** Population growth • Greenhouse gas emissions • Shared socioeconomic pathways • Economic development • Family planning

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## 7.1 Introduction

Several recent reports stress that climate change is accelerating and that its impacts may be more severe than earlier models suggested. Hansen et al. (2016, p. 3761) found evidence for acceleration of ice-melt and its relationship with storm intensity and concluded that "The modelling, paleoclimate evidence, and ongoing observations together imply that 2 °C global warming above the preindustrial level could be dangerous". Schleussner et al. (2016) demonstrated considerable difference in impact between 1.5 °C and 2 °C warming, but concluded that at best we may be able to minimise the period during which global mean temperature may temporarily exceed 1.5 °C. They highlighted the gap between current national commitments under the Paris Agreement and the emissions reductions needed to meet that agreement's goal to limit the increase in the global average temperature "to well below 2 °C above pre-industrial levels". Schellnhuber, Rahmstorf, and Winkelmann, 2016 observed that almost no scenarios so far modelled achieve a greater than 50% chance of remaining below 1.5 °C warming. Spratt (2016) emphasised that basing required action on a 50% probability of achieving a "safe" target does not meet any normal standards of risk management. He argued that there is already no carbon budget left if we are to have 90% chance of remaining under 2 °C.

Such urgency emphasises that action to reduce drivers of climate change must be taken on all effective fronts simultaneously. Focusing responses too narrowly will mean other necessary changes are addressed too late. All avenues to reduce emissions should be pursued, unless they compete directly for the same resources. Rockström et al. (2017) suggest a "roadmap" consistent with less than 2 °C warming that requires anthropogenic carbon dioxide emissions to peak before 2020 and halve each decade thereafter.

Yet there is one line of action that has so far been excluded from the discourse of the United Nations Framework Convention on Climate Change (UNFCCC). This is despite it being inexpensive, impacting climate adaptation and mitigation simultaneously, enhancing the impact of all other climate change responses and directly benefiting the poorest and most vulnerable sectors of humanity, particularly women and children in the least-developed countries. This low-hanging fruit is the extension of voluntary family planning and access to birth control, to minimise further growth in the human population.

In models of future greenhouse gas emissions, the contribution of population growth is often buried in model assumptions and uninterrogated in their analysis. For example, in the roadmap of Rockström et al. (2017), renewable energy roll-out is expressed only in terms of percentage share of primary energy. The prospect of a doubling or more in energy demand, and the attribution of this demand growth among population growth, economic development or technology change, is thereby avoided altogether. Such population-energy-technology (PET) analyses have found that the sensitivity of emissions to population change is greater than that to change in GDP per capita by a factor of more than two (Jorgenson & Clark, 2010) to almost seven (Casey & Galor, 2017) when considering only carbon dioxide emissions from fossil fuels and industry (FFI).

Given the less flexible relationship between population and demand for land resources, the common omission of emissions from agriculture, biomass use and land use change underestimates the influence of population on emissions. Bajželj et al. (2014) found that greenhouse gas emissions from the food system were sensitive to population outcomes by a factor of 1.9, meaning that a 10% increase in population would result in 19% more emissions from the food system, assuming the same wealth and dietary preferences.

Using an economic-demographic model, taking account of multiple channels of effects of change in fertility and population on economic growth, Casey and Galor (2017) estimated that moving from the medium to the low variant of the United Nations (2015) global population projection could reduce FFI emissions by 10% by 2050 and 35% by 2100, despite increasing income per capita. O'Neill et al. (2010), including emissions from the food system but using UN population estimates from 2003, estimated emissions reduction around 15% by 2050 and 35–42% by 2100. Their careful analysis accounted for changes in urbanisation, age distribution and household size on a country-by-country basis.

These studies applied alternative population projections as exogenous factors, without identifying to what extent specific measures would achieve lower population outcomes. In this analysis, historical evidence for the effect of both economic advancement and voluntary family planning programmes on population outcomes is examined; future projections are based on assuming the adoption of family planning programmes achieves the average outcome achieved by such programmes in the past. It therefore more directly addresses the value of including population measures in the climate change response.

## 7.2 Population Assumptions in Climate Change Scenarios

Predicting future greenhouse gas emissions, and the effect of mitigation measures, involves many assumptions about future trends in economic, social and technological change and international relations. To help make such assumptions explicit and consistent between modelling exercises, and to explore the likely range of outcomes, scenario narratives are built describing alternative possible futures.

The socioeconomic scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) have formed the basis of many attempts by independent research groups to model the impact of policy options on outcomes. The "shared socioeconomic pathways" (SSPs) described in the IPCC's Fifth Assessment Report (AR5) (IPCC, 2014) replace the previous SRES scenarios, named from the Special Report on Emissions Scenarios (IPCC 2000). The SSPs are likely to remain the dominant framework for modelling for some years. The SSPs comprise five scenario "families" (O'Neill et al., 2013). In the base case, the scenario describes a future without policies to address climate change, setting assumptions about trends in key drivers and the interactions between them. Against this, modellers may vary policy, technology and other assumptions to generate mitigation scenarios.

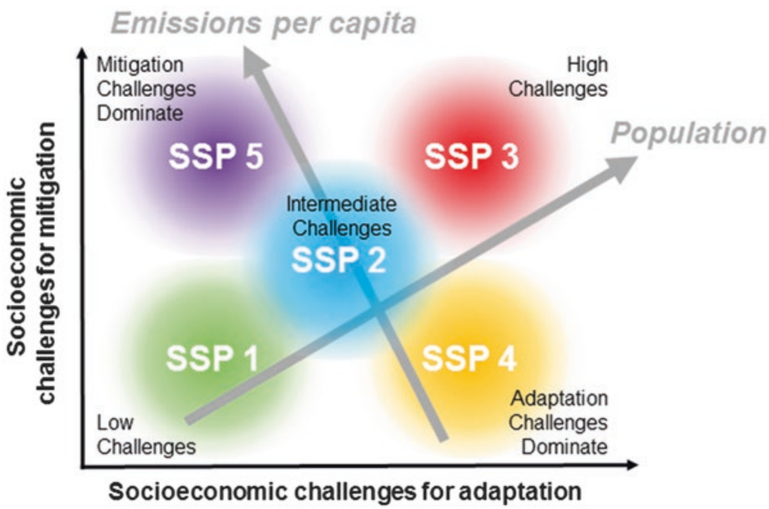


**Fig. 7.1** A conceptual map of the five families of IPCC Shared Socioeconomic Pathways (SSPs), in relation to the strength of mitigation and adaptation challenges posed by each scenario (after van Vuuren et al., 2014). Approximate trends in population outcomes and emissions per capita outcomes are superimposed. Population growth is most strongly related to adaptation challenges

Each of the SSPs has a different global population trajectory (van Vuuren et al., 2014). These projections depend primarily on the assumed timing, rate and extent of the fall in family size in remaining high-fertility countries, and to a lesser extent assumptions about change in mortality rates, migration and family size in low-fertility countries (i.e. those below the "replacement rate", around 2.1 children per woman, at which children just replace their parents' generation in the absence of migration). However, the SSPs do not differ with respect to actions to influence fertility—none are included in any of the scenarios. This is because family size outcomes are assumed to be a product of economic and educational outcomes (Samir & Lutz, 2014).

Figure 7.1 indicates the relative challenges posed for climate change adaptation and mitigation by each SSP baseline scenario and the approximate trends in population and emissions per person among the SSPs (their actual population projections are given in Fig. 7.7).

Notably, all but one (the worst-case scenario, SSP3) of the SSP scenario families anticipate a global population well below the UN's current medium projection—indeed, below the 95% probability range of the UN's 2015 probabilistic projections (UNDESA, 2015). The preferred scenario, SSP1, combines a very low global population with low per capita footprint in a world of more integrated and equitable governance. SSP5 combines a similarly low population path with high energy demands per person. For these two scenarios, the population path is lower than the UN's "low-fertility projection", which is not intended as a realistic scenario but as a sensitivity analysis: it merely applies a fertility rate (the average number of children per woman) 0.5 units lower than the medium projection in all countries with immediate effect. Fertility is expected to fall steadily under the UN's medium projection, but no faster or slower in the low and high projection after the initial adjustment of 0.5 units. However, a path similar to the SSP1 and UN low projection is achievable if fertility were reduced in remaining high-fertility countries faster and further than assumed in the UN projections.

The population outcome has enormous impact on prospects for both mitigation and adaptation, as Young, Mogelgaard, and Hardee (2009) also demonstrated with respect to the earlier SRES scenarios. Riahi, van Vuuren, and Kriegler (2017) reported that, across six independent integrated assessment models running a total of 105 mitigation scenarios, outcomes as low as 2.6 W/m$^2$ climate forcing (consistent with less than 2 °C warming) were found to be infeasible when applying SSP3. This was despite SSP3 assuming considerably less economic development than other scenarios. SSP3 also had no feasibility of increasing forest cover, and only SSP1 projected forest expansion as likely in the base scenario.

It is vital to note that each of the UN's revisions in the past decade has increased the expected population, because fertility decline is not happening as fast as its medium scenario expects. The UN's estimate for the year 2100 has increased by more than two billion in just 11 years (Fig. 7.2). This suggests that the feasibility of more favourable climate change outcomes is being eroded over time, as global population growth is exceeding the expectations of lower-emissions models.

The reason for these regular upward revisions is obvious when we look at annual increments of global population growth (Fig. 7.3). In many countries, rapid falls in fertility were occurring from the 1970s to 1990s, which enabled the global population increment to peak in 1988 and to decline throughout the 1990s. However, since 2000, the increment has increased again. This is the result of fertility decline slowing, stalling or reversing since the withdrawal of funding and political support for family planning programmes from the mid-1990s (Bongaarts, 2008). Countries such as Indonesia, Algeria and Egypt, which achieved considerable fertility decline under family planning programmes prior to the mid-1990s, have seen fertility increase again before reaching replacement rate. This reversal occurred despite accelerated progress on girls' education, child mortality and poverty reduction (factors popularly claimed to drive fertility decline), as these were high priority targets of the Millennium Development Goals (MDGs). The dramatic fall in international support for family planning (Fig. 7.3, right-hand axis) was the factor most consistent with this reversal (Sinding, 2009), providing evidence that its influence on population growth has been stronger than is commonly recognised. The goal of achieving universal access to sexual and reproductive health services was belatedly added to the MDGs in 2007, but remained the least addressed in its agenda.

Interruptions or reversals of the fertility transition, such as those in Egypt and Indonesia, are not accommodated in the UN's population model (O'Sullivan, 2016). The UN's medium projection continues to expect the downward trend in global increment to resume, based on immediate resumption of fertility decline in all high-fertility countries, despite many of them seeing little if any decline recently. As shown in Fig. 7.3, data on actual change in global population, reported annually

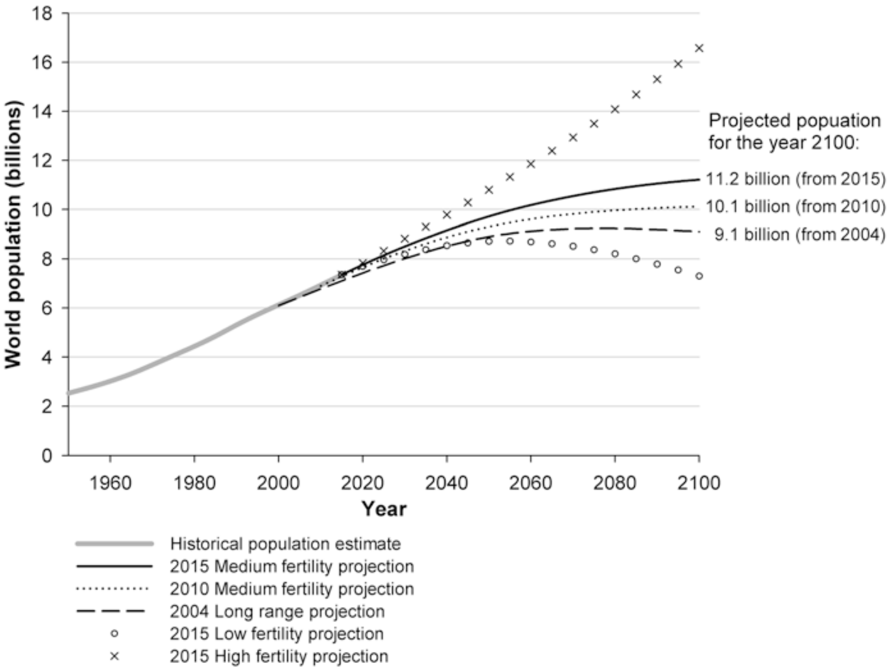


**Fig. 7.2** Population projections from the United Nations, showing the dramatic rise in expected outcomes since 2004. (Data sources: UNDESA, 2004, 2011, 2015)

by the Population Reference Bureau (PRB, 2011–2016), are greatly exceeding the "medium" projection and instead are approximating the "constant fertility" projection, which assumes all countries continue with the same fertility they had in 2010. If sustained, it results in a global population of 28 billion by 2100. Of course, such a population could not be fed—if fertility does not fall, then death rates must rise.

Yet, despite the poor track record of recent projections, most climate impact modellers continue to regard future population as predetermined. They do not consider what measures might be available to influence it. Most do not even acknowledge the uncertainty of population projections or consider any sensitivity analysis to see how emissions outcomes would be affected if population is higher or lower than expected.

Marangoni et al. (2017) attempted sensitivity analyses on the main drivers of FFI emissions in the SSP scenarios and concluded population growth was relatively unimportant compared with economic growth and energy intensity of the economy, although the latter two tended to offset each other. This outcome was a product of their methodology, which contrasted outcomes to 2050 in SSP2 projections when individual drivers were substituted from SSP1 or SSP3. Hence it highlighted whichever factors varied most in the short term between these three SSP scenarios, due to the arbitrary assumptions underlying those scenarios. They failed to acknowledge

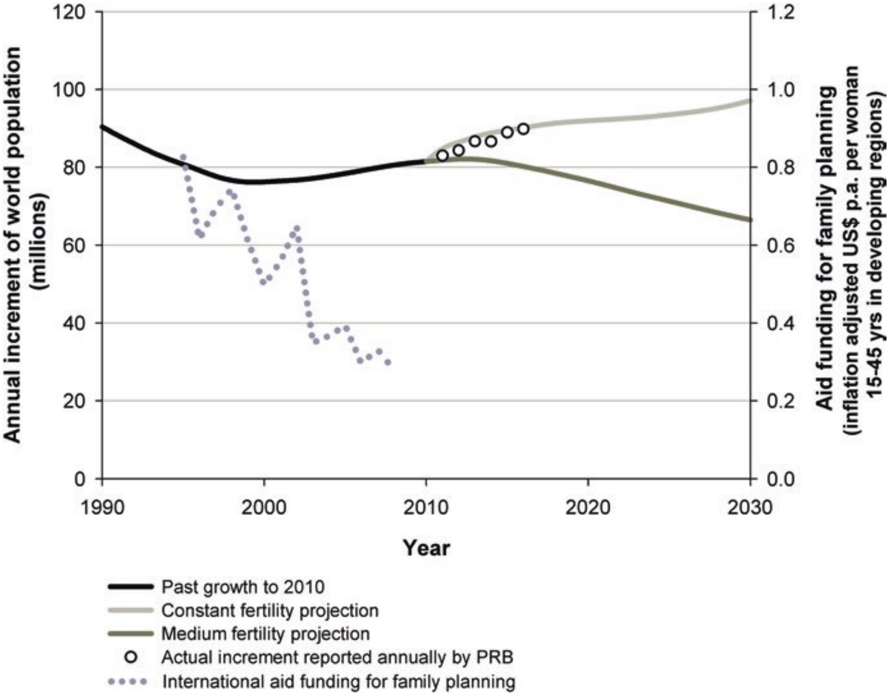


**Fig. 7.3** The annual increment of global population 1990–2010, and that projected under the UN's medium fertility and constant fertility projections (UNDESA, 2013). Black circles give estimates of actual increment reported annually in the Population Reference Bureau's "World Population Datasheets" (PRB, 2011–2016). International aid spending on family planning is plotted against the right axis. (Data source: UN Economic and Social Council, 2010)

that energy intensity of the economy and growth in GDP per capita are not independent factors but tend to offset each other—increasingly so as energy constraints intensify in the future. In most cases, if a higher assumption is imposed about future economic growth, a lower energy intensity is required to achieve it, so that the net effect is predictably smaller than the individual effects. The effect of population was further understated by omitting land use emissions and biomass sequestration.

In contrast, sensitivity analyses based on historical data have found population growth to be a stronger driver of emissions than economic growth. The studies of Jorgenson and Clark (2010), Casey and Galor (2017), O'Neill et al. (2010) and Bajželj et al. (2014) have already been mentioned. Alexander et al. (2015) found that population growth has been the largest driver of land use change, although dietary changes in emerging economies are an increasingly important contributor. The World Resources Institute's exemplary series Creating a Sustainable Food Future found that achieving replacement level fertility in sub-Saharan Africa by 2050 would spare an area of forest and savannah larger than Germany from conversion to cropland, and in doing so save 16 Gt of carbon dioxide emissions (Searchinger et al., 2013). The RoSE project, a major international effort to model energy and emissions pathways, discovered that a higher-than-expected population had a far greater impact on deforestation and land use-related emissions than high economic growth (Kriegler, Mouratiadou, Luderer, et al., 2013).

As illustrated in analyses such as those by O'Neill et al. (2010) and Casey and Galor (2017), the impact of a modelled change in demographic drivers is relatively small until mid-century, but expands greatly in the second half of this century. The slow divergence of population outcomes after policy change ("demographic momentum") is often used to argue that population measures should have lower priority compared with energy sector interventions. It should instead be a reason for even greater urgency, to ensure that the substantial gains are not further deferred, and that a higher peak population does not render safe climate scenarios infeasible. Neglect of population policy over the past two decades has likely added more than two billion people to the global peak population (Fig. 7.2). The low priority afforded to population measures implies that they would compete with other mitigation or adaptation efforts. This is a mistake, since family planning measures are usually cost-negative, saving health and education systems far more than they cost. Hence, they simultaneously liberate resources for other climate change and development measures and reduce the scale of other measures required to meet humanity's needs.

## 7.3 Relationship between Enrichment and Fertility Decline

Lower population outcomes may be widely recognised as beneficial for climate change adaptation and mitigation, and a faster decline in fertility in developing countries is accepted as necessary to achieve a lower population. However, there is disagreement regarding whether direct interventions are effective and appropriate to speed the fertility decline. The SSP scenarios assume that the low population outcomes can be achieved as a result of indirect effects of economic development and education, without any interventions directly aimed at lowering fertility. The historical record does not provide strong evidence for this position. No country has been able to achieve significant enrichment while fertility and population growth remained high, with the exception of those with large mineral resources. The latter, including Syria and Egypt, did not see fertility falling rapidly as a result of oil wealth, and have suffered a reversal of fortune as increasing dependence on food imports coincides with declining oil revenue (Ahmed, 2017).

In contrast, there is abundant evidence that population-focused voluntary family planning programmes were highly effective in causing rapid fertility decline and subsequently accelerated economic development. Countries such as South Korea, Thailand and Costa Rica, in which voluntary family planning was extended and promoted even to poor, rural and remote communities, saw rapid fertility decline, two to three times as fast as UN projections expect for remaining high-fertility countries (Fig. 7.4). They subsequently experienced broad-based economic development, accelerating only after fertility fell below three children per woman and population growth slowed. The timing of their fertility transition matched that of

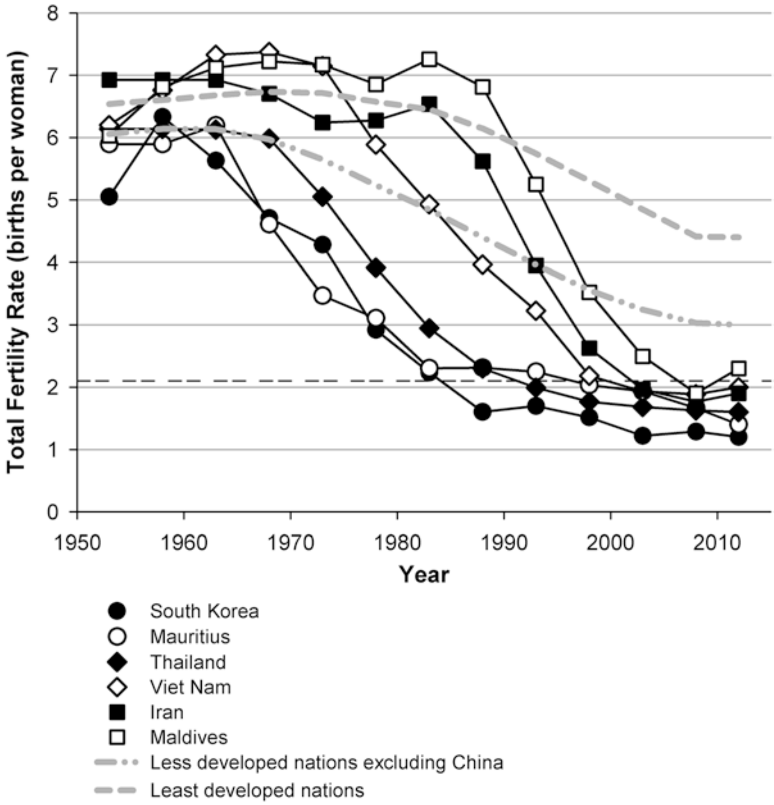


**Fig. 7.4** Time course of total fertility rate (TFR, births per woman) for selected countries that implemented population-focused voluntary family planning programmes at differing times, showing rapid change in fertility, compared with aggregate TFR for less developed countries (excluding China) and least-developed countries. The horizontal dashed line approximates "replacement level" fertility. (Data from UNDESA, 2015)

their family planning programmes, with no apparent economic or educational trigger. Meanwhile, some countries whose wealth and female education levels were above regional averages, such as the Philippines, Malaysia and Nigeria, saw little fertility decline. In several countries where family planning programmes were neglected before reaching replacement rate, such as Indonesia, Bangladesh, Algeria and Ghana, the fertility decline stalled and in some cases reversed.

Notwithstanding that these family planning-driven fertility transitions generally preceded economic and educational improvement, the overall correlation between GDP per person and total fertility rate of nations has led to the common assumption that economic development drives the fertility transition. To further investigate the direction of causation, Fig. 7.5 explores whether the level of wealth affected fertility decline, or whether fertility affected economic development. For all countries in each 5-year interval for which data were available, the change in fertility over 5 years was plotted against the level of GDP per capita at the start of the period

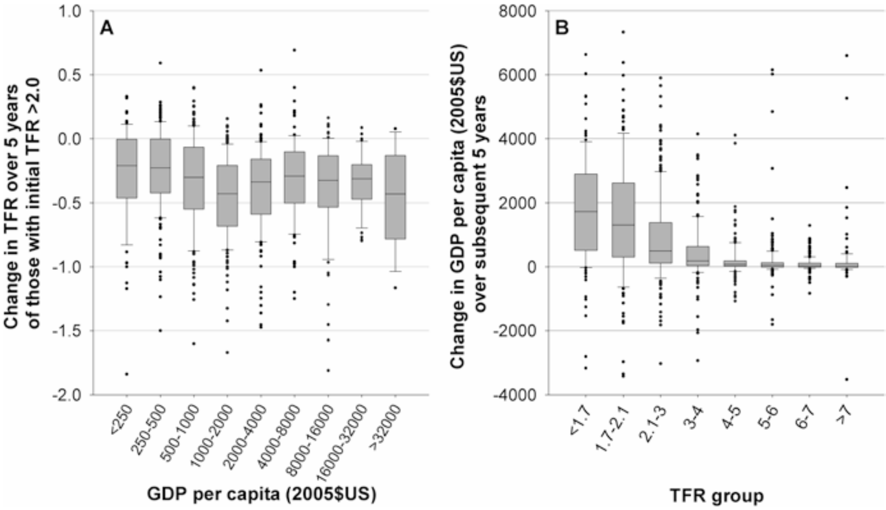


**Fig. 7.5** **(a)** The rate of fertility decline as a function of level of wealth and **(b)** rate of economic development as a function of level of fertility. Data points represent each country in each 5-year period between 1960 and 2010. All countries and time periods with available data are included. Box plots span 25th percentile, median and 75th percentile and whiskers extend to the 10th and 90th percentile. GDP per capita (inflation-adjusted US$2005) are from the World Bank economic database and fertility data from UNDESA (2015)

(Fig. 7.5a). It was found that the rate of fertility decline was unrelated to per capita GDP. The poorest countries could reduce fertility as rapidly as middle-income countries if they were motivated to do so. Conversely, when the change in GDP per capita was plotted against the total fertility rate (TFR) prevailing at the start of each interval, it is evident that economic development has been severely hampered by high fertility (Fig. 7.5b). When fertility remains above three children per woman, the chance of sustained economic improvement has proven to be extremely low. While low fertility has not guaranteed enrichment in any 5-year period, over 20-year intervals all low-fertility countries made considerable gains in wealth, including those with shrinking populations. Fertility decline appears to be a necessary, if not sufficient, precondition for economic development.

Figure 7.6 contrasts the experience of all countries that had high fertility in 1950, grouped according to their maximum rate of fertility decline over any 20-year period. Group 1 contained countries that had TFR above 5 at the start of the series (1950–1955) and where TFR fell after a particular date, at a rate exceeding 1.5 units per decade, to near or below replacement (unless insufficient time had elapsed since the start of decline). It was verified that each of these countries adopted voluntary family planning measures around the time that the birth rate began to fall, although not all maintained them until reaching replacement level fertility. Group 2 also showed considerable decline in TFR after a given date, but at a slower rate, between 0.5 and 1.5 units per decade. Group 3 showed no distinct start date for fertility decline and still have fertility rates above 4. Group 4 (not plotted) were considered "post-transition" countries that had fertility rates below 5 and falling at the start of

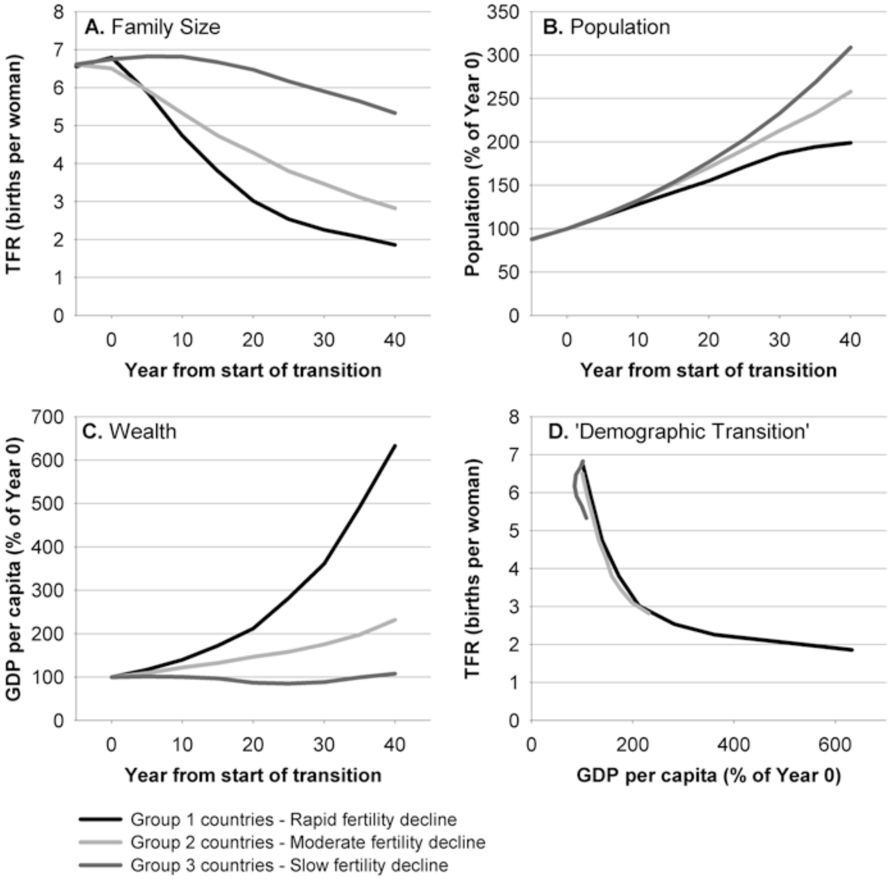


**Fig. 7.6** The averaged time course for **(a)** fertility, **(b)** population and **(c)** GDP per capita (inflation-adjusted US$), and **(d)** the relationship between total fertility rate (TFR) and per capita GDP, for developing countries grouped according to the rate of their fertility transition. Each of the rapid transition countries (Group 1) deployed successful family planning programmes. Many countries in Group 2 had programmes that were weaker or not sustained. Group 3 countries generally did not have widespread family planning efforts. Year 0 is the start of the fertility transition in each country, or 1970 for weak adopters (Group 3). Population and fertility data from UNDESA 2013, economic data from World Bank economic database

the data series. Countries where either immigration or emigration contributed more than 15% to population change were excluded. Before averaging each group's data, they were synchronised with respect to the timing of their fertility transition by designating Year 0 to be the start of the transition, or 1970 where no distinct change in fertility path is observed (Group 3).

The sixteen countries included in Group 1 were Algeria, Bangladesh, Bhutan, Cambodia, Chile, China, Costa Rica, Iran, South Korea, Libya, Maldives, Mongolia, Oman, Thailand, Tunisia and Viet Nam. Group 1 countries rejected due to high migration were Hong Kong, Macao, Singapore, Aruba, Kuwait and Saudi Arabia (high immigration), and Mauritius and Guyana (high emigration). Note that China is included despite the presence of coercive programmes from 1979 because most of the fertility decline occurred under the voluntary family planning programme in place from 1970 to 1978. Note also that the data are not population-weighted: China's data have no more influence on the average than those of Bhutan or Maldives. Group 2 contained 39 included countries and 48 high-migration countries, group 3 contained 26 included countries and 19 high-emigration countries.

Only Group 1 countries have achieved a tapering of their population growth (Fig. 7.6b). Most of these will achieve a peak population around 2–2.5 times the population when they started addressing family planning. Group 2 countries have lessened population growth but have not reduced family size as fast as the number of families has increased. Hence, most are still adding more people each year than ever before. Group 3 countries have seen their population triple in the same period. Due to their high proportion of young people yet to start families, they have another doubling in store if they choose to embrace family planning now (and more if they do not).

The impact of fertility decline on wealth can be seen dramatically in Fig. 7.6c. Rapid fertility decline has been associated with dramatic economic improvement. Slow-transition countries have seen virtually none. Figure 7.6d plots the fertility rate as a function of wealth. It contains two features that are at odds with the popular belief that development drives fertility decline:

1. The relationship between fertility and wealth is steeply concave, as *fertility fell first* before economic development accelerated.
2. *All three groups have followed the same path.* Those that accelerated fertility decline progressed more rapidly to economic development. With rare exceptions, "development first" has not been an achievable option.

These results do not suggest that ending poverty does not influence family size, but that reducing poverty as a population control strategy simply has not proven possible for most high-fertility countries. High population growth poses such a high economic burden, together with ongoing crowding of limited natural resources, that significant reductions in poverty have been impossible to achieve. Family planning programmes, on the other hand, have proven achievable even in the poorest settings, and the economic benefit to families has translated into societal enrichment.

## 7.4 How Much could Population Policy Measures Contribute to the Climate Change Response

Although the effects of a lower population on greenhouse gas emissions have been previously estimated (e.g. Casey & Galor, 2017; O'Neill et al., 2010), the effects of policies and programmes intended to reduce population have not been quantified. To address this question, population projections were compared under two scenarios: "business as usual" and a proactive family planning scenario. In the latter, all countries that currently have above-replacement fertility adopt voluntary, client-focused and culturally appropriate family planning measures, which seek to give all women the means to avoid unwanted pregnancy and which address traditional barriers to fertility regulation. It was assumed that each country would achieve the average path of fertility decline achieved in the past by Group 1 (as depicted in Fig. 7.6a), starting from their 2010–2015 fertility rate. This is a conservative scenario, as better contraceptive technologies, communications, education levels and community engagement methods all have the potential to make future programmes more effective than in the past. However, the projection is also quickly outdated: each year of delay in implementing such programmes would add around 100 million people to the achievable global peak population.

The business-as-usual scenario would see the international community continue to direct a derisory level of funding and programme attention to family planning (which receives less than 1% of international aid) and family planning programmes continue to lack the scale and visibility needed to reach the majority of disadvantaged people and to achieve rapid fertility decline. The fertility path applied to high-fertility countries (Group 3, Fig. 7.6a) continued forward using the UN's medium projection. However, each country's starting point on this path matched their current fertility, so that countries with current fertility above 5.5 experienced a further period of slow change before reaching the more rapid phase modelled in the UN projection. In addition, it was assumed that very low-fertility countries (below 1.5) were successful in boosting birth rates and achieved the UN's high projection (while remaining below replacement rate fertility).

Under these assumptions, a business-as-usual approach is likely to see growth exceed the UN's current medium projection, reaching 13 billion before the century's end (Fig. 7.7). It is questionable whether such a population would be achieved, but the risk is that it will be curtailed by widespread conflict and famine. Apart from being a catastrophe in its own right, such a scenario would likely derail climate action.

On the other hand, if the remaining high-fertility countries were to embrace voluntary family planning programmes, a global population path close to the UN's current low projection could be achieved. This would put the IPCC's best-case, SSP1 scenarios into the realm of possibility.

Although the proactive family planning scenario achieves a similar population outcome to the SSP1 model and the UN low-fertility variant, it does so in a very different and more plausible way. It is important to recognise that an avoided birth has more impact on future population if it occurs sooner rather than later. Delayed fertility decline allows the demographic momentum to build, so that greater fertility decline is ultimately required to achieve the same population. The UN's low-fertility projection is unrealistic, because while it assumes a very modest reduction in fertility (half a child per woman) compared with the medium scenario, it applies this reduction within the first 5-year interval. The SSP1 model, on the other hand, relies on future improvements in education and economic conditions to drive fertility decline, resulting in a later and more gradual decline, but declining to an extraordinary extent, settling around 1.2 children per woman across today's developing

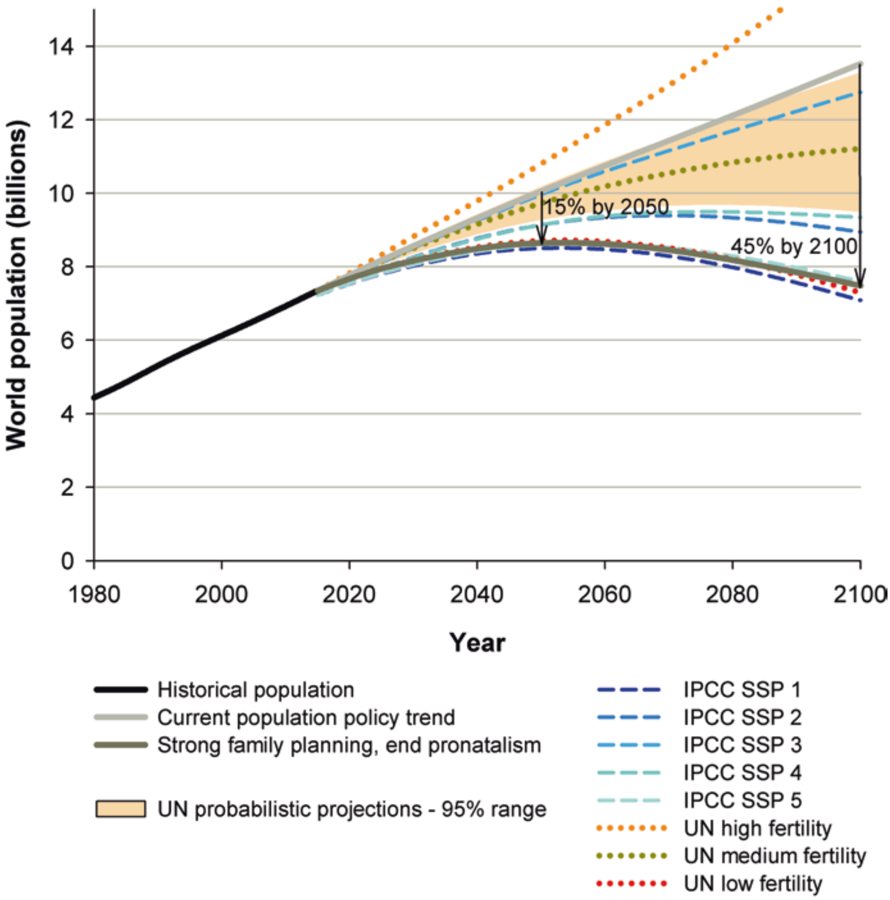


**Fig. 7.7** Projections of future global population based on population policy, comparing a business-as-usual scenario (countries continue their recent trends) and a proactive scenario (remaining high-fertility countries adopt nationwide voluntary family planning programmes, achieving the average fertility path that past programmes achieved, and low-fertility countries abandon attempts to increase births). Also depicted for comparison are the UN high-, medium- and low-fertility projections and 95 % probability range (UNDESA 2015) and the IPCC's Shared Socioeconomic Pathways (Samir & Lutz, 2014)

countries, despite developed countries remaining or rebounding to around 1.7 children per woman (Wittgenstein Centre for Demography and Global Human Capital, 2015). No explanation is offered for this astonishing assumption. In the proactive family planning model offered in the current study, fertility decline is rapid over the first three decades as a result of family planning programmes, but is expected to stabilise fertility not far below replacement, around 1.8–2.0 children per woman.

This analysis concludes that without urgent promotion of voluntary family planning, the population projection of SSP1 is not possible and "safe" climate change pathways are unlikely. In a world of 11 billion people, let alone 14 billion, considering the requirements for arable land, fresh water, nitrogenous fertiliser and building materials, even assuming 100% renewable energy, net drawdown of atmospheric carbon would require implausible levels of carbon capture and storage. It seems rash to turn our backs on technologies as cheap, reliable and widely beneficial as voluntary family planning in favour of technologies as unproven, costly and potentially damaging as carbon capture and storage.

## 7.5 Empowering Women and Couples to Control their Fertility is the Most Cost-Effective Climate Action

Wheeler and Hammer (2010) argued that climate finance could provide a much-needed boost to the long-neglected goal of universal reproductive rights. Using country-by-country analyses, they found that avoiding unwanted births through investments in family planning and girls' education would avoid greenhouse gas emissions at considerably lower cost than renewable energy initiatives, and lower than most reforestation initiatives. This was true even in countries where per capita emissions are very low. In more than 60 countries, the cost was less than $10 per tonne. Although spending on family planning avoided more births than spending on girls' education, the synergy between these activities meant that lowest-cost emissions reductions were achieved with a combination of both interventions. While the emissions reduction alone would justify the allocation of funds, the same investment would simultaneously empower women and improve health, nutrition, education and economic outcomes for families.

A USAID study of 16 sub-Saharan African countries in 2006 found that fulfilling the unmet need for family planning would not only contribute materially to the attainment of all other MDGs, but each dollar spent on family planning saved between two and six dollars by reducing the need for interventions to meet other development goals (Moreland & Talbird, 2006).

There is a high rate of unwanted pregnancy even in developed countries, where each avoided birth reduces far more emissions. Even in developed country contexts, net costs have been found to be negative. A recent programme to reduce teen pregnancies in the US state of Colorado lowered the teen birth rate and abortion rate by 40% and 42%, respectively, and saw a similar decline in the number of unintended pregnancies in unmarried women under the age of 25 (Tavernise, 2015). The programme saved Medicaid around $5.85 in perinatal care for every $1 invested (Colorado Department of Public Health and Environment, 2015).

It must be stressed that the successful voluntary family planning programmes of the past did not rely solely on ensuring access to contraception. Large desired family size remains the main determinant of high fertility. Even among those women who do not want to become pregnant, social and spousal pressure and misconceptions about side effects are more commonly cited reasons for not using modern contraception than lack of access and affordability (Ryerson, 2010). The successful programmes promoted the benefits of fewer, more widely spaced children, employed culturally appropriate means to change social norms around family size and women's roles, and addressed the many barriers to achieving fertility regulation (Campbell, Sahin-Hodoglugil, & Potts, 2009).

More recently, Population Health and Environment programmes, which integrate family planning with livelihood, public health and environmental management interventions, are showing that coherent cross-sectoral programmes can greatly increase community acceptance of (and even enthusiasm for) family planning, overcoming cultural resistance (PAI et al., 2015). Even in developed countries, where unintended pregnancy is associated with negative outcomes for women and children (Brookings Institute, 2011), proactive advice on fertility regulation is proving effective (Oregon Foundation for Reproductive Health, 2012).

All these programmes are consistent with the UN Programme of Action adopted at the 1994 International Conference on Population and Development (UNFPA, 1994), widely referred to as the Cairo Agenda, which is still upheld as the current international treaty on population. The Cairo Agenda stresses the negative impacts of population growth on the environment and on the alleviation of poverty and advocates responsible parenthood, in which parents should "take into account the needs of their living and future children and their responsibilities towards the community" (Para 7.3). The extent to which population growth heightens risks of climate change impacts should be among the considerations of prospective parents. Yet such a discourse is shunned by the UN and the development community in the name of the Cairo Agenda, wrongly claiming that demographic agenda by their nature conflict with reproductive rights (Campbell, 2014). This is a misrepresentation of the Cairo Agenda, which states (Para 7.12) that "Demographic goals, while legitimately the subject of government development strategies, should not be imposed on family planning providers in the form of targets or quotas for the recruitment of clients". Many successful family planning programmes prior to 1994 have demonstrated the strong synergy between pursuing demographic agenda and elevating women's health and rights. The post-1994 taboo on demographic goals has had tragic consequences, not least for women's reproductive health and rights, but also for the security of the next generation in the face of climate change.

## 7.6 High-Fertility Countries Face Multiple Challenges

As many commentators have observed, the effects of population change in sub-Saharan Africa dwarf the likely impacts of climate change on food and water security and on environmental damage. Fresh water access is a critical determinant of community resilience in this regard (Vörösmarty, Green, Salisbury, & Lammers, 2000). It has been estimated that we will need additional fresh water equivalent to 20 Nile Rivers to feed one billion more people (Bigas, 2012). Currently we are adding one billion every 12 years or less. Zeng, Neelin, Lau, and Tucker (1999) found strong evidence that the reduction in rainfall in West Africa over recent decades was due in larger part to regional vegetation change (deforestation) than to global climate change. Carter and Parker (2009, p. 676) evaluated threats to groundwater access in Africa, and observed:

> The climate change impacts [on groundwater] are likely to be significant, though uncertain in direction and magnitude, while the direct and indirect impacts of demographic change on both water resources and water demand are not only known with far greater certainty, but are also likely to be much larger. The combined effects of urban population growth, rising food demands and energy costs, and consequent demand for fresh water represent real cause for alarm, and these dwarf the likely impacts of climate change on groundwater resources, at least over the first half of the 21st century.

Figure 7.8 demonstrates how dramatically the projected increase in population will affect African countries' ability to feed their own populations in comparison with the modest changes in rainfall anticipated by Carter and Parker (2009). Food import dependence is growing in many African and Middle Eastern countries already (Worldwatch Institute, 2015), exposing them to global food price spikes that have been shown to be powerful triggers of civil unrest and violent conflict (Lagi, Bertrand, & Bar-Yam, 2011). The dashed lines in Fig. 7.8 demonstrate how much this challenge could be alleviated if these countries emulated the voluntary family planning successes of the past (using the same model described for Fig. 7.7).

While many commentators acknowledge the future risk of violence and displacement caused by population pressure, almost none are willing to recognise its role in current crises. The Population Institute's's (2015) Demographic Vulnerability Report noted:

> Population pressures are also contributing to environmental degradation and political instability. In effect, rapid population growth is a challenge multiplier, and for many developing countries the challenges are formidable.

A UK all-party parliamentary committee on population and development also warned (APPG, 2015):

> Population dynamics interact with climate change and with conflict to affect people and communities, and will increasingly do so over the course of the 21st century. If the world is to achieve sustainable development then there is an urgent need to scale up access to family planning, and to support sexual and reproductive health and rights.

Moreland and Smith (2012) found that even a modest increase in the rate of fertility decline in Ethiopia would negate the anticipated impacts of climate change on food security. Thankfully, Ethiopia and Rwanda are now making strong progress to extend and promote family planning, but most other east African countries are doing less well.

Apart from the density of population limiting access to natural resources and their services (particularly for the provision of food), the rate of population growth itself presents a formidable economic challenge to high-fertility countries. O'Sullivan (2012) demonstrated that the cost of providing infrastructure, equipment and trained service providers to cater for population growth greatly exceeds the extra economic activity that the additional people can generate. Using long time-series of actual national expenditure in the UK, O'Sullivan (2013) found that it takes around 7% of GDP to add 1% to the capacity of the nation's infrastructure in order

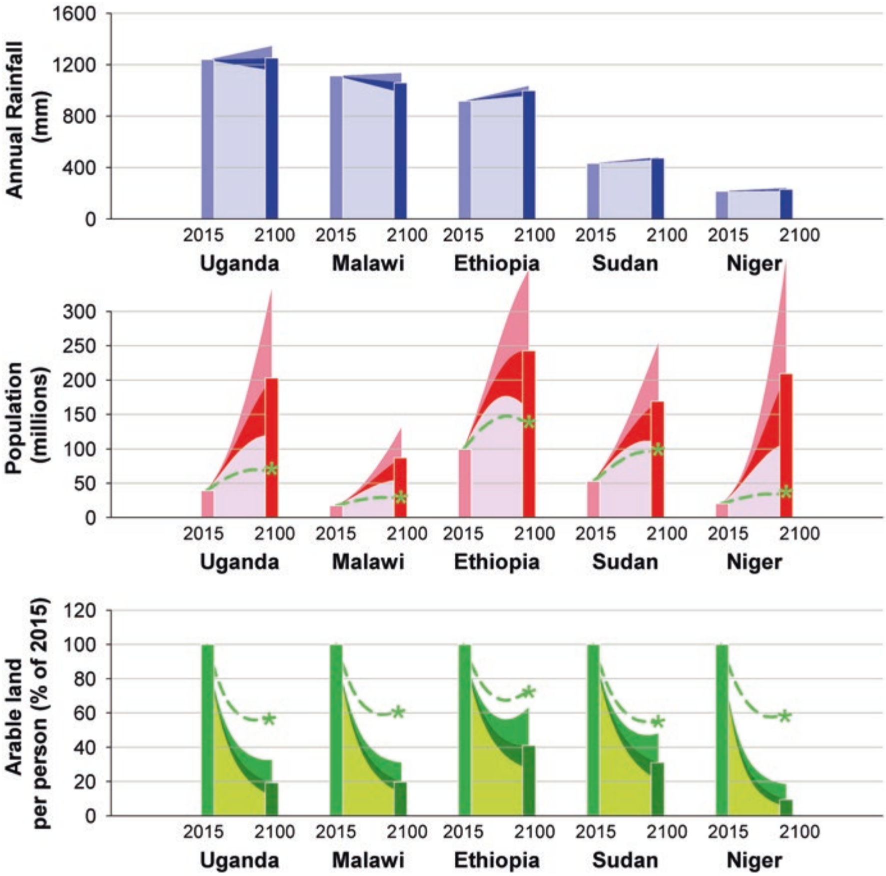


**Fig. 7.8** Projected change in rainfall due to climate change (from Carter & Parker, 2009) and in population (from UNDESA, 2015) in five sub-Saharan African countries. Histograms give the medium projection, and area plots indicate the likely range (for population, this is the 80% range using UN probabilistic projections; UNDESA, 2015). Arable land per person is calculated as a percentage of that currently available. The dashed pathways are those that would be achievable if the proactive scenario described in Fig. 7.7 were rapidly initiated

to accommodate 1% more people. An African country growing at 2.5% per annum might require 17% or more of its GDP to be diverted to infrastructure creation that achieves no improvement, merely running in order to stand still against the tide of population growth. This impost, rather than any shortage of land or water, explains the near-absence of economic development in high-fertility countries presented in Figs. 7.5 and 7.6. Its alleviation is likely to have played a greater role in the "Asian Tiger" economies than the more commonly cited "demographic dividend" resulting from shifts in population age distribution (Bloom & Williamson, 1998).

Mutunga and Hardee (2010) reviewed the National Adaptation Plans for Action prepared by least-developed countries during the UNFCCC's 2009 climate adaptation agenda. They found that 37 out of 41 NAPAs highlighted population growth and density as factors increasing vulnerability, but only one proposed project included a population component and none were funded. The UNFCCC guidelines lacked appropriate categories in which population action could be presented as valid climate action. Without including discussion of population dynamics in the climate change discourse, this situation is unlikely to be remedied.

## 7.7 Conclusion

A safe climate future depends on minimising further growth in the human population. Strengthening efforts to empower women, to avoid unwanted births and to popularise smaller families through voluntary, rights-based family planning programmes are necessary measures without which low-emissions scenarios cannot be achieved (Guillebaud, 2016).

The IPCC socioeconomic scenarios that achieve low emissions, consistent with less than 2 °C global warming, assume very low population growth, far lower than current UN expectations (Riahi et al., 2017; Schellnhuber et al., 2016). Yet no programmes are included in these scenarios to achieve this lower population because it is assumed that strong economic development and educational advances will achieve it. Evidence presented in this chapter finds that:

(a) Current trends are for a higher, not lower, population than current UN expectations, rendering most future emissions scenarios invalid.
(b) In most countries, economic advance has not been a major driver of fertility decline; on the contrary, fertility decline, driven by voluntary family planning programmes, has enabled economic advance. Such programmes have been neglected in recent decades, to the great detriment of the world's poorest people and their environment.

Restoring the international support for voluntary family planning programmes, which existed in the 1970s and 1980s, could reduce the peak human population by many billions. Such action would reduce emissions at lower cost than almost all other options, while simultaneously improving climate change resilience of disadvantaged communities and achieving a wide range of co-benefits with respect to health, the status of women, economic development of least-developed nations, nutrition and food security, conflict avoidance and protection of biodiversity.

The United Nations' Sustainable Development Goals include target 3.7: "By 2030, ensure universal access to sexual and reproductive healthcare services, including for family planning". Few people appreciate that most other Sustainable Development Goals targets depend on achieving this long-neglected goal (Starbird, Norton, & Marcus, 2016).

As Cleland et al. (2006) emphasised, "No contradiction needs to exist between respect for reproductive rights and strong advocacy for smaller families and for mass adoption of effective contraceptive methods". Past population-focused family planning programmes greatly accelerated the empowerment of women and the adoption of more liberal social attitudes to women's roles and rights. Their daughters benefited from the improvement in social attitudes, from less economic strain in the household and from greater parental investment in their outcomes, including better nutrition and improved access to schooling and employment opportunities. The economic and environmental benefits for entire nations were evidently substantial. All of these improvements lessen vulnerability to the impacts of climate change. Yet these manifold benefits have not proven compelling enough for the international community to provide the modest resources needed to extend reproductive freedom to women in the remaining high-fertility countries. The imperative of avoiding dangerous climate change may be the incentive that is needed to harvest what is clearly the low-hanging fruit for sustainable development.

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