

Comment



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Women in Niger and other parts of the Sahel are among the least empowered globally, but various efforts are starting to provide solutions.

Avert catastrophe now in Africa's Sahel

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Governments worldwide must invest in girls' education, family planning, agriculture and security in this vulnerable region.

World leaders have a disappointing record when it comes to crises that take decades to unfold. Much greater investment in the prevention of HIV/AIDS in the 1980s could have saved millions of lives and billions of dollars 20 years later, for instance.

The western Sahel region of Africa lies between the Sahara Desert to the north and the Sudanian Savannah to the south. By 2050, the region's population is expected to more than double, to 450 million¹, and temperatures there are expected to rise to about 3 °C above their 1950 level.

Already, hunger and malnutrition are

widespread in the Sahel. As droughts and other weather extremes make it even harder for farmers to produce the crops and livestock needed to sustain the growing population, conflict and terrorism will increase². As conditions worsen, millions of people could die in famines, and there is likely to be unprecedented levels of migration, including to Europe³.

Our analyses of population projections and the probable impacts of climate change on food security in this ecologically vulnerable zone indicate that four steps are needed to head off these effects. We call on governments worldwide, together with those

928M

The number of people expected to live in the Sahel by 2100, according to the UN's medium variant projection. Around 200 million live there today.

of seven countries spanning the Sahel (see 'Defining the Sahel'), to invest in girls' education; expand people's access to family-planning information and services; increase agricultural production; and increase security using local police forces as well as national and international military services.

Neglect just one of these actions, and political or economic systems could fail.

A powder keg

Over the past eight years, we have tracked links between demography and food security in six countries – Senegal, Mauritania, Mali, Burkina Faso, Niger and Chad – and the northern states of Nigeria, where Hausa–Fulani people are in the majority. We selected these mainly Muslim countries and states (which we call the Sahel study region, SSR) because they have similar climates and histories of colonization, and because the people living there have similar livelihoods, as well as some cultural connections.

Throughout this region, people are already living on the edge.

Population growth is outstripping food supply in the Sahel⁴. Relief efforts, such as those provided by the United Nations' World Food Programme, are struggling to meet the demand for emergency food assistance. Data from the World Bank show that stunting (in which a child's height is more than two standard deviations below the World Health Organization's median for that age group) currently affects 17% of children under five in Senegal, and 42% in Niger.

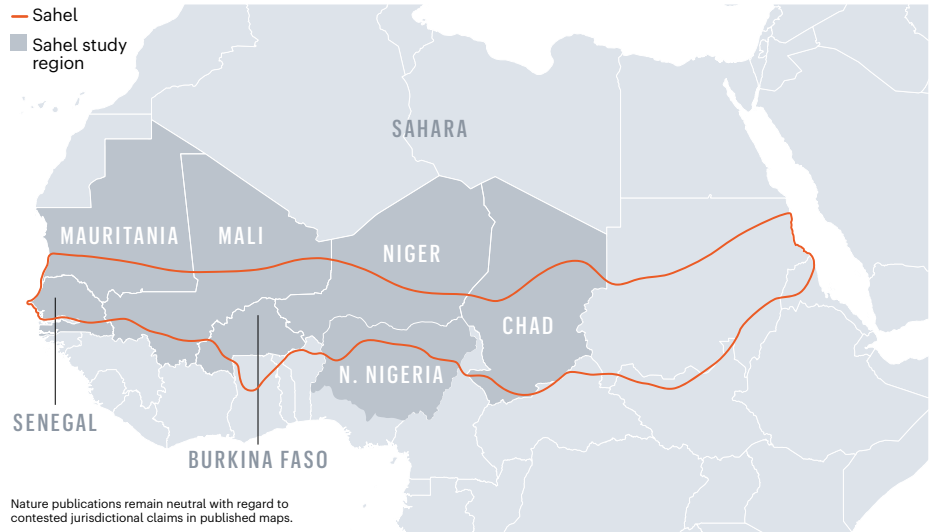
Because of the lack of clean water and sanitation services, the SSR has the world's highest mortality from waterborne diseases: around half a million people here die from diarrhoeal disease and cholera each year.

Women in the SSR are among the least empowered in the world. Many don't have a say in their own basic life choices, such as when and whom to marry, or whether to work outside the home. They also lack the freedom to seek health care as needed. Niger and Chad have the world's lowest median age of marriage among girls (around 16 years old) and – together with Mali – among the highest rates of adolescent births. In these three countries, 36–40% of women give birth before they are 18 years old. Such women are more likely than older mothers to deliver a preterm or low-birth-weight baby and to experience complications during childbirth⁵.

Rapid population growth is undermining the quality of both primary and secondary education. It means that fewer resources are

DEFINING THE SAHEL

The Sahel is a dry zone between the Sahara Desert and the Sudanian Savannah. It has no strict borders and is changing as the desert moves south. We focus on six countries and northern Nigeria: the Sahel study region.



available per child⁶. In Niger and northern Nigeria, it is increasingly common for schools to teach half the children in the morning and half in the afternoon, because there are too many students and not enough teachers.

Violence in the Sahel is rising rapidly, too. As population growth forces producers of crops such as sorghum and millet to expand their fields, herders and farmers are increasingly clashing. Women in Niger have on average 7.6 children, and in some northern Nigerian states, more than 8. These large families are relying on ever-smaller plots of land on which to grow food and graze their animals, mainly cattle and goats. According to the World Bank, Niger's arable land per capita shrank from 1.4 hectares in 1996 to 0.8 in 2016.

“Population growth is outstripping food supply in the Sahel.”

Meanwhile, violence linked to militant Islamist groups is escalating. In Chad and Mauritania, average military spending as a proportion of gross domestic product is approaching that of the United States – at around 3%. In 2016, the same figure for Niger was around 6.4%. Even so, governments are struggling to keep people safe outside of large cities. According to the Africa Center for Strategic Studies, the number of violent incidents attributed to militant Islamist groups roughly doubled from 90 in 2016 to 194 in 2017, and more than doubled again to

465 in 2018 (see go.nature.com/2c7tkeq).

Yet all of these challenges could pale in comparison to what lies ahead.

Grim view

Farmers in the Sahel are highly dependent on rain-fed agriculture, which is hugely vulnerable to climatic fluctuations. The record droughts of the 1970s and 1980s (which have been linked to climate change⁷) killed more than 100,000 people and left some 750,000 dependent on food aid, while affecting most of the 50 million people in the Sahel region. Future climate change is expected to have even greater impacts.

Today, 30–60% of the SSR's population is unemployed. These figures will worsen over the next decade, as more than half the population – currently under 18 – become adults. As a 2004 report⁸ by the 9/11 Commission, set up to investigate the 2001 terrorist attacks on the United States, observed: “A large, steadily growing population of young men without any reasonable expectation of suitable or steady employment [is] a sure prescription for social turbulence”.

Deteriorating food and economic security in the SSR could lead to failed states. As well as being disastrous for the people living there, countries that are unable to perform fundamental functions, such as the provision of health care, education and food to their citizens, can prove extremely costly to the global economy. Somalia's collapse in the 1990s increased pirating in the Gulf of Aden and the Indian Ocean, for instance. In turn, that cost the shipping industry an estimated

Comment

US\$18 billion annually, because cargo ships were forced to take alternative routes.

West Africa is the origin of more migrants than any other region of Africa⁹. A 2017 study predicts that millions of people could be forced to leave the Sahel by the end of this century³.

Four recommendations

As time passes, adapting to the interactions between climate change and population growth will become ever harder. Acting now is imperative. Here are our proposals.

Invest in girls' education; reconsider marriage laws. Numerous studies over at least three decades have shown that investing in a girl's education is a powerful way to bring about all sorts of other improvements, for instance in her and her family's health, and in her children's education¹⁰.

Women in SSR countries who have completed secondary school have two fewer children, on average, than do those with no schooling. These women are more likely to marry later and overcome barriers to accessing family planning. In fact, demographers estimate that population growth in countries with fertility rates comparable to those in the SSR could be slowed by 15–20% if women delayed marriage and childbearing by five years¹¹.

It is not necessarily enough to ensure that more girls go to school. The Centre for Girls Education (CGE) in Abuja, a non-governmental organization that is working to help girls in the Sahel to transition to secondary school, provides a good model for governments, non-governmental organizations and other groups to follow. (Two of us, A.G. and A.M.N., have partnered with the CGE, and co-signatory D. P. is a co-founder of and adviser to the organization.)

Through ethnographic studies conducted in Nigeria in 2007, researchers from the University of California, Berkeley, and the CGE first established that poor-quality education is the biggest factor causing girls to drop out of school in rural communities. (Parents are not motivated to send their children to secondary school when they can't read or write after six years of primary school.) The researchers then created 'safe-space clubs' in which mentored groups of up to 18 girls attending their final year in primary school or first year in secondary school could build a support network and get help with reading and writing, as well as with self-expression, negotiation, reproductive health and other crucial life skills.

After participating in the programme for two years, girls in Kaduna state in northern Nigeria were 20 times more likely to complete secondary school than were other girls in their communities. They also got married around 2.5 years later than non-participating girls¹².

We estimate that a similar 'safe-space' programme could be rolled out for all girls aged 14 across the entire SSR for \$641 million per year. This represents about 12% of the total annual aid received by the SSR countries (excluding northern Nigeria).

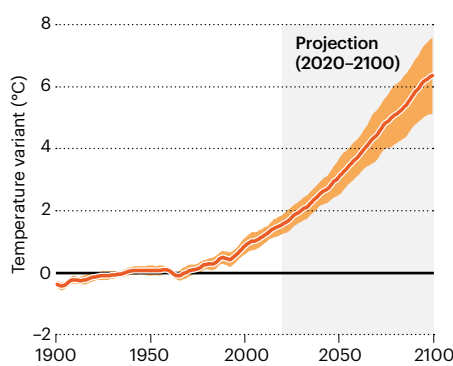
As well as investing in girls' education, countries should adopt and enforce laws establishing a minimum age for marriage or change current minimum ages. Although culturally sensitive, this recommendation is in accordance with the African Charter on the Rights and Welfare of the Child, which all SSR countries have ratified. This sets the minimum age of marriage at 18. Currently, across the SSR, the

PERFECT STORM

Droughts and other weather extremes brought about by climate change are making it even harder for farmers in the Sahel to produce the crops and livestock needed to sustain a growing population.

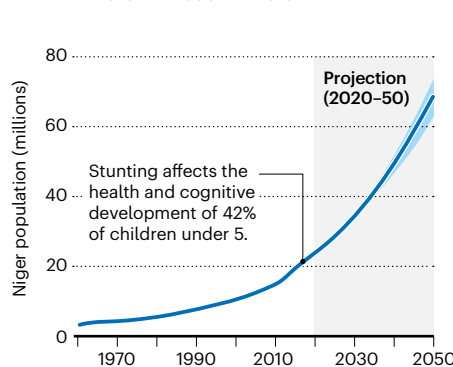
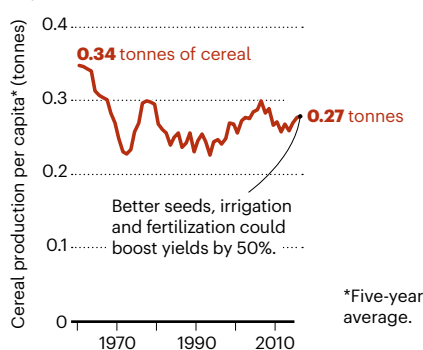
Temperature change in Sahel study region

By 2050, temperatures are expected to be about 3 °C above their 1950 levels.



Cereal production and population in Niger

Between 1960 and 2016, cereal production per capita decreased.



minimum legal age of marriage for girls is 15 or 16. In northern Nigeria, it is as low as 12. Globally, countries with consistent laws setting the age of marriage at or above 18 have 40% fewer child marriages and 25% fewer teenagers having babies than do countries without consistent laws¹³.

Expand access to family planning. The use of contraception is increasing globally. Various studies show that when people are given good information and services relating to contraceptives, they want to use them¹⁴. Our analysis shows that, with the exception of Senegal, there are more women in the SSR who want to stop or delay childbearing but are not using contraception than there are current contraceptive users. (In Senegal, political will has helped to double the contraceptive prevalence in the past 7 years.) We estimate that meeting these women's needs would lower the total fertility rate by 1–1.5 children per woman¹⁵.

All sorts of approaches to improve access to contraceptives have been successful in other mainly Muslim countries. The total fertility rate in Iran fell from 6 births per woman in 1986 to 2.2 in 2000 following a national family-planning programme that included the integration of high-quality services into the primary health-care system and the provision of free contraceptives. This is a faster decline than has occurred in any other country.

Given the dearth of doctors and nurses, national guidelines are needed to make it easier for community health workers to provide family-planning services, especially in rural areas. Legislation passed in Niger earlier this year, for instance, now permits community health workers to give people injectable contraceptives. (The World Health Organization approved this practice more than 20 years ago.) Ethiopia is a leader on this. Thanks to the country's investments in rural health services, and the steps taken to enable community health workers to provide contraceptives and related services, Ethiopia might achieve the UN's medium population projection of 191 million by 2050, as opposed to the high projection of 212 million. This could result in around one million fewer malnourished children by mid-century¹⁶.

Increase agricultural production. Current crop yields are at least 50% below what they could be were farmers to use the best available seeds, as well as the optimal irrigation and fertilizer schemes that are feasible for the region. Today, only 4% of SSR cropland is equipped with any kind of irrigation infrastructure, and the average application rate for fertilizer is 10 kilograms per hectare – one-tenth of the global average.

With investments in irrigation, we calculate that, under current climate conditions, it would be possible to feed 140 million more



Investing in education for girls, such as at this school in Niger, has been shown to improve their health and that of their future families.

people in the SSR, without damaging freshwater ecosystems or depleting groundwater stocks¹⁷.

The Sahel is already prone to unpredictable rainfall, soil degradation and erosion – all of which are expected to worsen with global warming. Farming approaches that enable crop growers to retain enough rainwater to bridge the dry season (by collecting run-off, reducing evaporation or improving infiltration) must be scaled up.

Burkina Faso, for instance, has increased its yields of millet and sorghum by up to 500% by adopting the Zai technique. Here, pits are dug in the soil to concentrate water and nutrients, and seeds are placed in the pits rather than scattered over the soil. Other water-harvesting techniques include terracing, mulching (the use of bark and other plant matter to reduce evaporation and enrich the soil), no-till farming (whereby farmers use hoes or other tools to remove weeds instead of ploughs) and contour stone bunds (the building of rock walls that prevent the soil from being washed away).

Agroforestry, combining agriculture and forestry, can also increase food production and resilience to climate change. In Niger and Mali, trees grown at the edge of fields or among crops increase the fertility and moisture of the soil by producing leaf litter and shading, among other benefits. The development of new varieties of cereal (within limits) that are locally adapted and drought-tolerant could help to improve agricultural production as the effects of climate change intensify (see ‘Perfect storm’).

Improve security. US military spending in the Sahel soared from zero in 2008 to more than \$400 million in 2016. Spending by European Union institutions more than doubled in that time, to greater than \$800 million¹⁸. The French counter-terrorist military intervention in Mali alone is costing \$2.2 million a day. This kind of external support is crucial. Yet, over the longer term, foreign boots on the ground rarely, if ever, build stability.

Between 2012 and 2018, Burkina Faso increased its per-capita spending on security from \$8.9 to \$15.8; Mali’s increased from

“Over the longer term, foreign boots on the ground rarely, if ever, build stability.”

\$9.3 to \$25.9 over the same period. This has almost certainly meant a reduction in the already insufficient spending on health and social services – the upstream investments that are imperative for ensuring a country’s long-term stability. In Mali, spending on health per capita fell by nearly 30% between 2013 and 2016 – from \$42 to \$30 (ref. 19).

To avoid a vicious cycle of reduced spending on basic services, escalating violence and yet more resources being shunted towards security, there must be greater cooperation between the security and humanitarian communities. Although people in humanitarian organizations have vastly different

approaches and cultural norms from local police forces and national and international military organizations, these two communities invariably work side by side and rely on each other. Building more trust and aligning operations better would help to achieve the same end.

At least three actions are needed to encourage the international community to increase its spending on security in the SSR. First, receiving governments must be fully transparent about where aid money goes. Second, if full transparency can be achieved, spending on security should be included in the definitions of official development assistance, along with spending on clean water, education, governance assistance and so on. Third, the World Bank, the International Monetary Fund and European donors, such as the French Development Agency AFD or the UK Department for International Development, should commit to funding deficits induced by spending more on security¹⁸.

Act now

The humanitarian community tends to develop short-term plans and budgets spanning 3–5 years. Often this is because organizations are constrained by limited resources and are struggling to address immediate problems, such as refugees fleeing conflict or ecological disasters. Yet acting to prevent crises before they become acute is much more cost-effective in the long term.

What’s more, expert recommendations for



PASCAL MAITRE/PANOS PICTURES

A French soldier in a market in Mali.

food security and other development goals almost always sidestep the possibility of slowing population growth through investing in girls and women. This is partly out of fear of being perceived as coercive following abhorrent abuses of reproductive rights – as occurred in India in the 1970s, when the government used various measures from propaganda to bribes to increase male and female sterilization¹⁹.

Yet there have been many more cases of coercive pregnancy than coercive contraception. In fact, women being denied information and contraceptives is itself a human-rights violation. In countries that are reliant on US family-planning assistance, modern contraceptive use declined by 14% and abortion rates rose by 40% in 2001 and 2008 when the US government implemented its Mexico City Policy. This blocks federal funding for foreign non-governmental organizations that provide abortion counselling or referrals, advocate to decriminalize abortion or expand abortion services. The current version of the policy is more restrictive and is probably associated with even higher numbers of unintended pregnancies.

The humanitarian implications of the emerging crisis in the Sahel must be brought to the table at high-level meetings of the UN, African Union and EU. The OASIS Initiative (Organizing to Advance Solutions in the Sahel), which was co-founded by A.G. and co-signatory M.P., plans to hold a conference with Sahel and European partners next year to

increase donor investments in girls' education and family planning.

Over the past three decades, we estimate from UNAIDS data that HIV/AIDS has killed around 22 million people in sub-Saharan Africa. Over the coming three decades, population growth and climate change in the Sahel could threaten the well-being of hundreds of millions – unless the four recommendations we lay out here are enacted now.

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