

# AFRICAN FUTURES BRIEF

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## TAPS AND TOILETS

### HOW GREATER ACCESS CAN RADICALLY IMPROVE AFRICA'S FUTURE

*Authors: Mark Eshbaugh, Eric Firnhaber, Patrick McLennan, Jonathan D Moyer, Erin Torkelson*

**An aggressive yet reasonable annual improvement in water and sanitation for Africa will lead to:**

- **18 million fewer malnourished children by 2030**
- **US \$ 75 billion increase in GDP by 2040**
- **17 million fewer people living on less than US \$ 1,25 a day by 2050**

#### INTRODUCTION

Access to safe water and sanitation is a fundamental component of human development. In Africa, more than 350 million people lack access to safe drinking water<sup>1</sup> and over 530 million do not have access to safe sanitation.<sup>2</sup> It appears increasingly likely that the continent will fall short of relevant Millennium Development Goals (MDGs).

Effective policy decisions supported by the international community can, however, improve these conditions. Malawi, Burkina Faso and Ghana reduced the number of people with no access to safe water by an average of 1,9 percentage points per year from 1990–2008. For sanitation, Angola, Madagascar and Ethiopia reduced the number of people with no access by a similar rate. What if the rest of the continent followed these examples?

Improving access to safe water and sanitation across Africa at rates of just under 2 percentage points annually – as compared with base case

improvements which are closer to 0,5 percentage points – will reduce the number of undernourished children by 18 million by 2030, increase the continent's GDP by US \$ 75 billion by 2040<sup>3</sup> and bring 18 million people out of poverty by 2050.<sup>4</sup> On the other hand, if improvements stagnate, malnutrition and poverty will increase, and GDP growth will be stymied.<sup>5</sup>

Achieving a 2 percentage point annual improvement in water and sanitation is no small feat. We calculate that the public cost will be nearly US \$ 35 billion invested over the next 40 years. This is in addition to the base case investment of US \$ 110 billion that is required to maintain current water and sanitation infrastructure and build base case levels of new infrastructure. We calculate that the lion's share of increased investment should go towards improvements in safe sanitation with a smaller share for safe water.<sup>6</sup>

Our results about the effects of access to water and sanitation on infant mortality, malnutrition, poverty, and economic growth are broken down for 52 African countries.<sup>7</sup> Full data tables can be found at [www.ifs.du.edu/afp](http://www.ifs.du.edu/afp).

#### IMPORTANCE OF WATER AND SANITATION FOR HUMAN DEVELOPMENT

Lack of access to safe water and sanitation increases health risks that include diarrhoea, malnutrition and

parasites. These conditions reduce quality of life and decrease productivity. The extent of these health problems is hard to overstate. In 2004, the World Health Organisation estimated that nearly 2 million deaths and over 64 million ‘disability adjusted life years’ (DALYs)<sup>8</sup> related to diarrhoeal diseases were attributable to unsafe water and sanitation.<sup>9</sup>

Children are disproportionately affected by health conditions resulting from no access to water and sanitation. At least one quarter of all child deaths and one fifth of the child disease burden (predominantly diarrhoea and under-nutrition) are caused by inadequate access to water and sanitation.<sup>10</sup> For Africa, the under-five mortality rate attributed to diarrhoea is 15,8 per 1 000. This is much higher than the average global under-five mortality rate of 8,9 per 1 000.<sup>11</sup>

Diarrhoea resulting from inadequate access to safe water and sanitation also leads to malnutrition. Even if humans have access to sufficient calories, diarrhoea can stop them from absorbing key vitamins and nutrients, leading to poor health and stunted growth. The size of the malnourished child population in Africa speaks to this phenomenon. Twenty-eight% of African children live without adequate nutritional absorption. This is above the global average of 18%.<sup>12</sup>

The high number of DALYs lost reduces both the quality and size of the labour force, as time lost to diarrhoea would otherwise be spent by children in school or by adults at work. This reduction leads to decreased economic productivity. A study by the World Health Organisation found that improved water and sanitation services would reduce diarrhoeal episodes by roughly 10%, leading to an annual reduction in health-related costs of US \$ 7,3 billion. The study also found that investing in water and sanitation facilities would realise a substantial economic return. Each US dollar invested would yield an economic return of between US \$ 3 and US \$ 34, depending on the region.<sup>13</sup>

## HISTORICAL TRENDS IN WATER AND SANITATION ACCESS

The percentage of people in Africa with access to safe water and sanitation is lower than any other global region. Currently, only 65% of people in Africa have access to safe water, while in Asia that figure

stands at 88%, with Latin America at 93% and Europe at 99%. The situation is similar for access to safe sanitation. In Africa, only 41% of the population has access to safe facilities, while Asia has sanitation access levels of 53%, Latin America 79% and Europe 95%.<sup>14</sup>

While improving access to water and sanitation is important at all levels of quality, this analysis focuses on the percentage of people with no access at all. We use water and sanitation access data from the Joint Monitoring Programme of the World Health Organisation and the United Nations Children’s Fund.<sup>15</sup> Table 1 reveals how different measures of access are treated by this database. We use three categories of access to water and sanitation derived from the table below: no access, improved access and household connection.<sup>16</sup>

**Table 1: Definitions for water and sanitation access data**

	Water	Sanitation
No Access / Unimproved	Unprotected well, surface water, bottled water	Open defecation in field, forest water, or other open spaces / Pit latrine without slab, bucket latrine
Improved (Shared)	Public tap, tube well, protected well	Any category of household connection that is shared among more than one household
Household Connection	Piped connection in dwelling or plot	Flush or pour toilet, pit latrine with slab, composting toilet in dwelling or plot

**Source:** World Health Organisation and United Nations Children’s Fund Joint Monitoring Project, *The Drinking Water and Sanitation Ladders*, <http://www.wssinfo.org/definitions-methods/watsan-ladder/> (accessed March 2011).

## DEVELOPING THREE SCENARIOS

For our scenario development, we ranked all African countries by the average annual change in percentage points of people with no access to safe water and sanitation from 1990–2008. This allowed us to identify the countries with the largest positive and negative growth.<sup>17</sup>

Historically, the three best performers with respect to

safe water reduced the portion of the population with no access by an average of 1,9 percentage points annually, which is the same rate of progress as the three best performers with respect to access to safe sanitation. The worst performers increased the percentage of people with no access to safe water and sanitation by 0,6% and 0,3%, respectively. For our analysis, we created three scenarios that extend to 2030.

1. Our first point of reference is the **International Futures base case**, which assumes basic continuity of global policy and trends, although it is not an extrapolation. The full range of assumptions in the base case scenario can be found online.<sup>18, 19</sup>
2. Our **aggressively improved scenario** reduces the number of people with no access to water and sanitation by 1,9% annually across the continent, which is the average rate of the best performing countries.
3. Our **stagnant scenario** does not replicate the negative growth in countries listed above but instead stagnates improvement in access to water and sanitation at 2010 levels across our time horizon.

## THE TOOL: INTERNATIONAL FUTURES

We used the International Futures (IFs) model to analyse trends across a wide range of key global systems.<sup>20</sup> The IFs model provides forecasts for 183 countries to 2100. IFs is housed at the Josef Korbel School of International Studies at the University of Denver, and is freely available to download or use at [www.ifs.du.edu/ifs](http://www.ifs.du.edu/ifs). Please access documentation on the website or other IFs publications for more detail

**Table 2 Best and worst performers for access to water and sanitation**

	Water		Sanitation	
	Country	Average Annual Percentage Change	Country	Average Annual Percentage Change
<b>Best Performing</b>	Malawi	2,2%	Angola	2,11%
	Burkina Faso	1,94%	Madagascar	1,83%
	Ghana	1,6%	Ethiopia	1,77%
<b>Worst Performing</b>	Sierra Leone	-0,65%	Mauritania	-0,5%
	Algeria	-0,61%	Liberia	-0,28%
	Sudan	-0,44%	Tanzania	-0,22%

**Source:** International Futures Team Analysis. World Health Organisation/United Nations Children's Fund Joint Monitoring Project for Water Supply and Sanitation, Data Tables, <http://www.wssinfo.org/data-estimates/table/> (accessed March 2010).

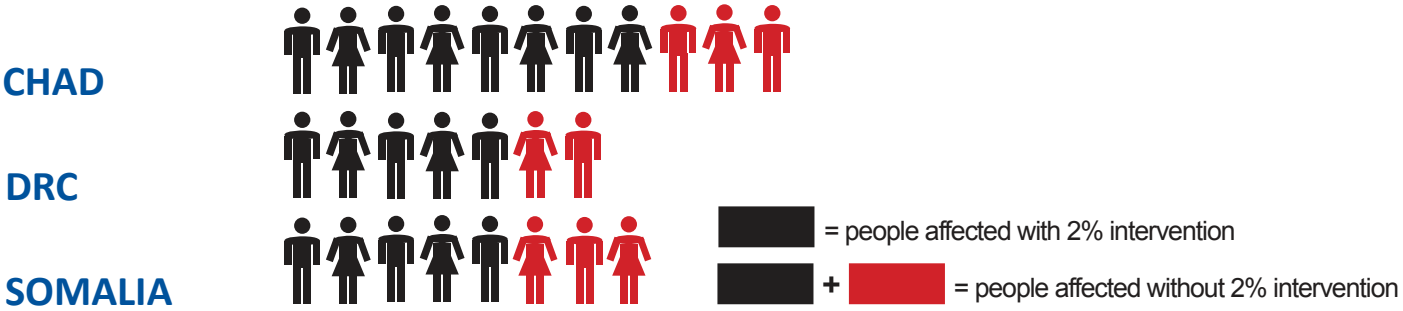
on the model structure and assumptions.

The IFs model drives access to water and sanitation as a function of the following variables: government spending on health, size of the total population, size of the urban population, average years of education for those under 25, and the absolute number of people living on less than US \$ 1,25 per day at purchasing power parity. On the other side of the function, access to safe water and sanitation affects the mortality rate by various subcategories: infant mortality, life expectancy, and levels of malnourishment. Extended documentation of the model can be found in the Patterns of Potential Human Progress Improving Global Health Volume.<sup>21</sup>

# If each country in Africa were 100 people

...and the number of Africans with access to water & sanitation increased by 2% per year

## BY 2030: INFANT MORTALITY PER 100 LIVE BIRTHS



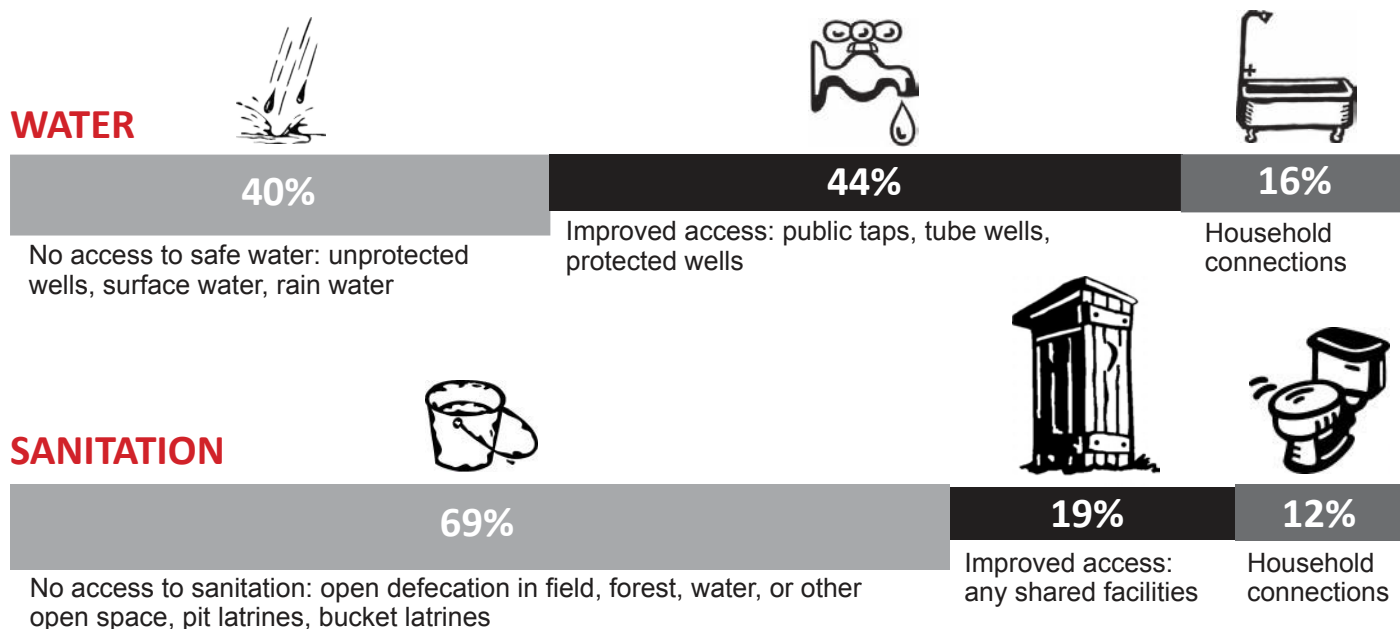
## BY 2040: NUMBER OF UNDERNOURISHED CHILDREN IN 100



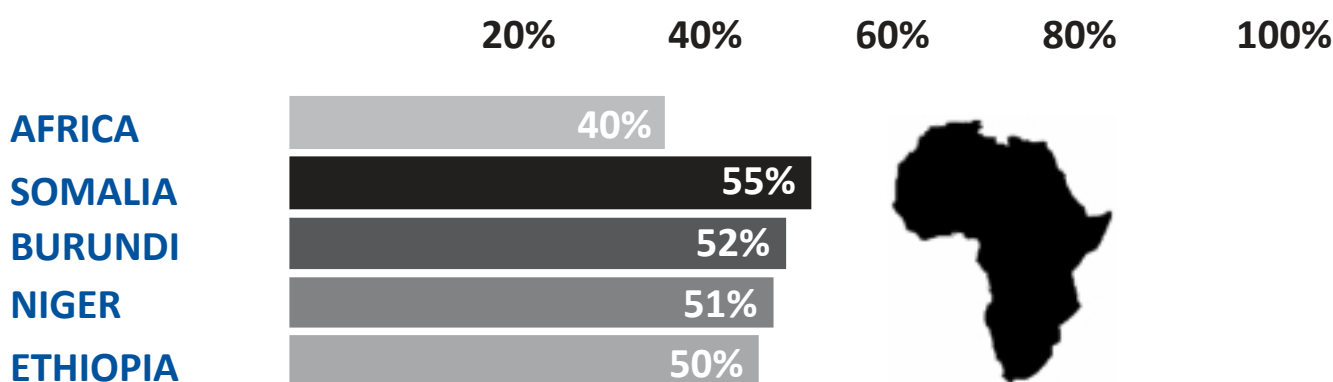
## BY 2050: NUMBER OF PEOPLE IN 100 LIVING AT \$1.25 PER DAY



## IN 2010: ACCESS TO WATER AND SANITATION IN SUB-SAHARAN AFRICA



## BY 2030: PROBABILITY OF STATE FAILURE



## BY 2050: CONTINENT-WIDE GDP

	INVESTMENT	GDP PER CAPITA (MER)
<b>BASE CASE</b>	\$110 Billion	\$3 300 per capita
<b>AGRESSIVE CASE</b>	\$145 Billion	\$3 400 per capita



## EXPERIENCES ON THE GROUND

While policy-making should be locally derivative and context specific, several of the best-performing countries provide useful insights on how to meet the MDG for water and sanitation. Our best-performing countries confirm that challenges within the water and sanitation sector do not result from technological or geographical considerations. Rather, the most important factors governing the delivery of water and sanitation are related to the public policy environment, institutional management, finance and the overall social structure of a country. The first three factors have been explored in some detail in a 2006 UN report on progress towards the MDGs,<sup>22</sup> and the fourth has been posited by Jose Esteban Castro.<sup>23</sup>

Our *aggressively improved* scenario is based on countries like Burkina Faso, which has shown a 1,94% increase each year in the number of people gaining access to safe water. Burkina Faso's National Office for Water and Sanitation (ONEA) has been tasked with implementing the Action Plan for the Integrated Management of Water Resources (PAGIRE) and is widely considered to be one of the best performing utilities in West Africa.<sup>24</sup> Operating via public-private partnership, ONEA covers 42 cities and towns and uses a cross-subsidy model to recoup expenditure from the end users. ONEA has provided water access in urban areas and small towns with more than 5 000 inhabitants, but low-density rural areas have not benefited from this programme and require special attention. Additionally, there has been some significant criticism regarding the privatisation of utilities and their dependency on a cost recovery model. Analysts have suggested that this model does not adequately provide for the water needs of a particular population, instead placing long-term mortgages on the poorest countries and failing to reach the most vulnerable citizens.<sup>25</sup>

In reference to sanitation, our *aggressive* scenario is based on countries like Ethiopia, which has shown a 1,77% increase in access to sanitation each year. The Ethiopian Government sees sanitation as an important precursor to poverty eradication, and has thus emphasized sanitation in policies produced by the Ministries of Health and Water Resources. Unlike other countries, which view sanitation as a component of a larger water strategy, Ethiopia has

developed a specific sanitation and hygiene strategy that focuses on low-cost sanitation coupled with hygiene promotion as part of a health extension programme.<sup>26</sup> Additionally, Ethiopia has prioritised the delivery of sanitation in rural areas and among the most vulnerable members of the population. While there has been some difficulty identifying the Ministries responsible for various components of sanitation delivery, a 2006 memorandum of understanding has since clarified institutional responsibility.

For all six countries in this study that showed very positive results, the following factors have been crucial to their success: strictly defined institutional arrangements, clear policy frameworks and substantial donor funding.

## FINDINGS

By 2050, improved access to water and sanitation increases African GDP by 3% over the base case, and 6% over the pessimistic scenario. The difference in income between the base case and the improved case in 2050 – over US\$ 200 billion – is larger than most economies in Africa in 2011.<sup>27</sup> The cumulative, discounted difference between these scenarios across time approaches US \$ 700 billion, and more than pays off the additional investment of US \$ 35 billion over the next 40 years.

Improved access to water and sanitation over the base case dramatically changes levels of undernourished children in Africa. By 2030, the number of undernourished children is reduced by 18 million. By 2040, four countries have more than one million fewer undernourished children compared with base case improvements. These are the Democratic Republic of Congo (2,9 million fewer undernourished children), Nigeria (1.9 million), Ethiopia (1.7 million) and Niger (1.3 million). By 2050, 32 African countries reduce the number of undernourished children by over 50% compared with base case forecasts.<sup>28</sup> Full results on a country-by-country basis can be found at [www.ifs.du.edu/afp](http://www.ifs.du.edu/afp).

Infant mortality is also dramatically reduced. By 2030, our aggressive scenario forecasts a 20% reduction in infant mortality<sup>29</sup> over the base case. In absolute figures, this translates to roughly nine fewer infant deaths per 1 000 live births. Over the same period, an aggressive improvement in water

and sanitation reduces infant mortality by 10 live births per 1 000 for 20 countries, with the greatest reductions occurring in Chad (reduction of 35 per 1 000), Somalia (reduction of 25) and the DRC (reduction of 21). Improvements are more pronounced when comparing the aggressive scenario with the stagnant scenario. Infant mortality levels are 30% higher in the stagnant case than in the improved scenario, with nearly 14 more deaths per 1 000 live births in 2030.

By 2050, improvements in water and sanitation lead to 17 million fewer people living on less than US \$ 1,25 per day. The greatest reductions in the number of people living in poverty occur in the Democratic Republic of the Congo (5.7 million fewer people), the Ivory Coast (1.4 million people) and Mali (1.1 million people). These improvements in human development take place with an African population that is significantly higher in our aggressive scenario relative to the base case. By 2050, the population of Africa is 11 million people larger than in the base case.

These water and sanitation scenarios also have a bearing on the probability of state failure across the continent. On average, the probability of state failure is 40% higher in 2030 if nothing is done to improve access to water and sanitation compared with rapid improvements. In 16 African countries, the probability of state failure increases by more than 20% in 2030. The largest increases in the probability of state failure between a stagnant and improved water and sanitation scenario occur in Somalia (55% increase), Burundi (52% increase), Niger (51% increase) and Ethiopia (50% increase).<sup>30</sup>

## CONCLUSIONS

Improvements in the most basic levels of access to water and sanitation can have sizeable impacts on several key areas of human development. This brief highlights the importance of a sustained effort by domestic leaders and the international community to promote access to these basic resources. Further research should explore the governance structures and policies most conducive to increasing access to safe water and sanitation and the role of international aid in the improvement of this infrastructure.

## NOTES

<sup>1</sup> Number derived from multiplying the percentage of people in Africa with no access to safe water (36,31%) by the population of sub-Saharan Africa (1,005 billion). Both figures are derived from the International Futures model version 6.44. See Figure 1 for a more detailed description of different categories of water access.

<sup>2</sup> Number derived by multiplying the percentage of people in Africa with no access to sanitation services (53,09%) by the population of sub-Saharan Africa (1,005 billion). Both figures derived from the International Futures model, version 6.44. See Figure 1 for a more detailed description of different categories of sanitation access.

<sup>3</sup> All information presented in this policy brief related to aggregate sums of money across time are calculated using a 3% discount rate.

<sup>4</sup> Measured by those living on less than US \$ 1,25 per day.

<sup>5</sup> Comparing the strong improvement scenario with a stagnate scenario produces the following: by 2030 there are nearly 30 million more children living with malnutrition, by 2040 the GDP is US \$ 525 million less and by 2050 there are over 28 million more people living in poverty.

<sup>6</sup> US \$ 23 billion increase over base case investment in sanitation relative to US \$ 11 billion increase over base case in water (differences due to rounding).

<sup>7</sup> The model does not calculate variables for Western Sahara, Seychelles or a separation between South and North Sudan.

<sup>8</sup> A Disability Adjusted Life Year (DALY) is defined by the World Health Organisation as the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability. World Health Organisation, [http://www.who.int/mental\\_health/management/depression/daly/en/](http://www.who.int/mental_health/management/depression/daly/en/) (accessed March 2010).

<sup>9</sup> Barry Hughes, Randall Kuhn, Cecilia Peterson, Dale Rothman and Jose Solorzano, Improving Global Health. Patterns of Potential Human Progress 3 (2011), Oxford University Press and Paradigm Publishers, Pardee Center for International Futures: University of Denver, <http://www.ifs.du.edu/documents>

<sup>10</sup> Lorna Fewtrell, Annette Prüss-Üstün, Robert Bos, Fiona Gore and Jamie Bartram, Water, Sanitation and Hygiene: Quantifying the health impact at national and local levels in countries with incomplete water supply and sanitation coverage, WHO Environmental Burden of Disease Series, No. 15, World Health Organisation, Geneva (2007), 43, 45.

<sup>11</sup> World Health Organisation Statistical Information System, <http://www.who.int/whosis/whostat/en/index.html> (accessed March 2010).

<sup>12</sup> World Health Organisation Statistical Information System, <http://www.who.int/whosis/whostat/en/index.html> (accessed March 2010).

<sup>13</sup> World Water Council, <http://www.worldwatercouncil.org/index.php?id=23> (accessed March 2010).

<sup>14</sup> World Health Organisation/United Nations Children's Fund Joint Monitoring Project for Water Supply and Sanitation, Data Tables, <http://www.wssinfo.org/data-estimates/table/> (accessed March 2010).

<sup>15</sup> Data was originally gathered from national statistics offices and international survey programmes through nationally representative household surveys and national censuses. World

Health Organisation, <http://www.wssinfo.org/definitions-methods/data-sources/> (accessed March 2010); and World Health Organisation/United Nations Children's Fund Joint Monitoring Project for Water Supply and Sanitation, The Drinking Water and Sanitation Ladders, <http://www.wssinfo.org/definitions-methods/watsan-ladder/> (accessed March 2010).

<sup>16</sup> Data on no access to sanitation is coded in two categories: 'no access' and 'other unimproved access'. We combine these two data sources into one category, which we refer to as 'no access' for the remainder of this analysis.

<sup>17</sup> World Health Organisation/United Nations Children's Fund Joint Monitoring Project for Water Supply and Sanitation, The Drinking Water and Sanitation Ladders, <http://www.wssinfo.org/definitions-methods/watsan-ladder/> (accessed March 2010).

<sup>18</sup> To further explore the assumptions made throughout the IFs model, please visit the following URL and explore the available publications: <http://www.ifs.du.edu/documents/reports.aspx>

<sup>19</sup> Due to the difference in JMP definitions of improved and unimproved water and sanitation access, for our forecast we defined our variables as 'household connection,' 'improved' and 'no access,' grouping together the historical definition 'unimproved sanitation' with 'no access' to sanitation.

<sup>20</sup> IFs: The International Futures (IFs) modelling system, version 6.44 was used for the development of this report. IFs was initially developed by Barry Hughes and is based at the Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, <http://www.ifs.du.edu>. 2011.

<sup>21</sup> Barry Hughes, Randall Kuhn, Cecilia Peterson, Dale Rothman and Jose Solorzano, *Improving Global Health. Patterns of Potential Human Progress 3* (2011), Oxford University Press and Paradigm Publishers, Pardee Center for International Futures: University of Denver, <http://www.ifs.du.edu/documents>

<sup>22</sup> Roberto Lenton, Kristen Lewis, and Albert Wright, Water, Sanitation and the Millennium Development Goals, *Journal of International Affairs*. Vol. 61(2), (2008), 249.

<sup>23</sup> Jose Esteban Castro, Introduction, *Water and Sanitation Services: Public Policy and Management*, Jose Esteban Castro and Leo Heller (eds), London: Earthscan, 2009, 36.

<sup>24</sup> Information taken from a regional initiative by the African Ministers Council on Water, African Development Bank, EU Water Initiative, Water and Sanitation Programme and United Nations Development Programme, *Getting Africa on track to meet the MDGs for water and sanitation: a status update of sixteen countries*, [http://www.wsp.org/wsp/sites/wsp.org/files/publications/319200\\_725615\\_312007101903\\_MDGs\\_All\\_final3\\_high.pdf](http://www.wsp.org/wsp/sites/wsp.org/files/publications/319200_725615_312007101903_MDGs_All_final3_high.pdf) (accessed March 2011).

<sup>25</sup> Jose Esteban Castro, Introduction, *Water and Sanitation Services: Public Policy and Management*, Jose Esteban Castro and Leo Heller (eds), London: Earthscan, 2009, 36.

<sup>26</sup> African Ministers Council on Water, African Development Bank, EU Water Initiative, Water and Sanitation Programme and United Nations Development Programme, *Getting Africa on track to meet the MDGs for water and sanitation: a status update of sixteen countries*, [http://www.wsp.org/wsp/sites/wsp.org/files/publications/319200\\_725615\\_312007101903\\_MDGs\\_All\\_final3\\_high.pdf](http://www.wsp.org/wsp/sites/wsp.org/files/publications/319200_725615_312007101903_MDGs_All_final3_high.pdf) (accessed March 2011).

<sup>27</sup> GDP at market exchange rates in 2000 US dollars.

<sup>28</sup> The numerical reduction in 2030 between the base case and improved scenario is higher than the difference between the two scenarios in 2050, even though the percentage reduction is greater in 2050. This is because the percentage of undernourished children also drops significantly in the base case after 2030.

For more information on this reduction, see: Barry Hughes, Randall Kuhn, Cecilia Peterson, Dale Rothman and Jose Solorzano, *Improving Global Health. Patterns of Potential Human Progress 3*, Oxford University Press and Paradigm Publishers, Pardee Center for International Futures: University of Denver, 2011, <http://www.ifs.du.edu/documents>

<sup>29</sup> Infant mortality refers to child deaths before their first birthday. This is measured by deaths per 1 000 live births.

<sup>30</sup> For example, if there was a 10% probability that Niger will experience state failure over the next 5 years, a 50% increase in that value would put their probability of state failure at 15%. The variable used in IFs for this calculation is SFINSTABMAG.

## AFRICAN FUTURES PROJECT

The African Futures Project is a collaboration between the Institute for Security Studies ([www.issafrica.org](http://www.issafrica.org)) and the Frederick S Pardee Center for International Futures ([www.ifs.du.edu](http://www.ifs.du.edu)) based at the Josef Korbel School of International Studies at the University of Denver. The Institute for Security Studies is a widely recognized pan-African think tank specializing in issues of human security. The Pardee Center is the home of the International Futures model, an integrated approach to understanding human development and the broad implications of policy choices. These organisations leverage each other's expertise to provide forward-looking, policy-relevant material that frames uncertainty around human development in Africa.

Series editors: Jonathan D Moyer ([jmoyer@du.edu](mailto:jmoyer@du.edu)) and Erin Torkelson ([etorkelson@issafrica.org](mailto:etorkelson@issafrica.org))

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