CLIMATE AND HEALTH COUNTRY PROFILE – 2015
KENYA

World Health Organization

United Nations Framework Convention on Climate Change

OVERVIEW

The Republic of Kenya has a varied climate. It is hot and humid at the coast, temperate inland, and arid or semi-arid with minimal rainfall in the northeast. However, Kenya has multiple vulnerabilities to climate change: the country may likely see an increase in the intensity of floods common to the region (page 2), alongside changing temperature and rainfall patterns. Such climate-driven events will impact on recent gains in social development and public health [World Bank Country Overview, 2015].

The risk of malaria and other vector-borne diseases are projected to increase in future years due to changing climate conditions. More severe and frequent flooding may displace communities and increase the risk of water-borne diseases, and higher temperatures may threaten food and nutritional security, agricultural livelihoods, and increase heat-related deaths in the elderly.

The government's development strategy acknowledges such challenges yet commits to economic growth whilst building "a just and cohesive society with social equity in a clean and secure environment" [Kenya Vision 2030 – Social Pillar]. Furthermore, mitigation and adaptation measures – such as Early Warning Systems for malaria – are being implemented in an attempt to limit the impact of climate change [WHO Climate Change Adaptation to Protect Human Health. Kenya Country Profile. http://www.who.int/globalchange/projects/adaptation/en/index6.html].

SUMMARY OF KEY FINDINGS

- Under a high emissions scenario, mean annual temperature is projected to rise by about 4.5°C on average from 1990 to 2100. If emissions decrease rapidly, the temperature rise is limited to about 1.2°C (page 2).
- Under a high emissions scenario, and without large investments in adaptation, an annual average of 503,600 people are projected to be affected by flooding due to sea level rise between 2070 and 2100. If emissions decrease rapidly and there is a major scale up in protection the annual affected population could be limited to about 500 people (page 3).
- Under a high emissions scenario heat-related deaths in the elderly (65+ years) are projected to increase to about 45 deaths per 100,000 by 2080 compared to the estimated baseline of under 2 deaths per 100,000 annually between 1961 and 1990 (page 4).

OPPORTUNITIES FOR ACTION

Kenya has an approved national health adaptation strategy and has conducted a national assessment of climate change impacts, vulnerability and adaptation for health. Additionally, Kenya is currently implementing projects on health adaptation to climate change and implementing actions to build institutional and technical capacities to work on climate change and health. Country reported data (see section 6) indicate that there remains further opportunities for action in the following areas:

1) Adaptation

- Estimate the costs to implement health resilience to climate change and include estimates in planned allocations from domestic and international funds.

2) Mitigation

- Conduct a valuation of co-benefits to health of climate change mitigation policies.

3) National Policy Implementation

- Continue implementation of the national climate change action plan (NCCAP, 2013–2017) which aims to build an enabling policy and regulatory framework supporting low carbon climate resilient development.

DEMOGRAPHIC ESTIMATES	
Population (2013)[a]	43.69 million
Population growth rate (2013)[a]	2.7 %
Population living in urban areas (2013)[b]	24.8 %
Population under five (2013)[a]	16.0 %
Population aged 65 or older (2013)[a]	2.7 %
ECONOMIC AND DEVELOPMENT INDICATORS	
GDP per capita (current US$, 2013)[c]	1,257 USD
Total expenditure on health as % of GDP (2013)[d]	4.5%
Percentage share of income for lowest 20% of population (2012)[c]	NA
HDI (2013, +/- 0.01 change from 2005 is indicated with arrow)[e]	0.535 ▲
HEALTH ESTIMATES	
Life expectancy at birth (2013)[f]	61 years
Under-5 mortality per 1000 live births (2013)[g]	53

a World Population Prospects: The 2015 Revision, UNDESA (2015)
b World Urbanization Prospects: The 2014 Revision, UNDESA (2014)
c World Development Indicators, World Bank (2015)
d Global Health Expenditure Database, WHO (2014)
e United Nations Development Programme, Human Development Reports (2014)
f Global Health Observatory, WHO (2014)
g Levels & Trends in Child Mortality Report 2015, UN Inter-agency Group for Child Mortality Estimation (2015)

1 CURRENT AND FUTURE CLIMATE HAZARDS

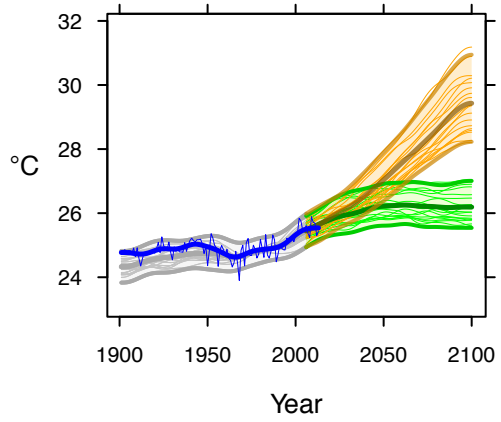
Due to climate change, many climate hazards and extreme weather events, such as heat waves, heavy rainfall and droughts, could become more frequent and more intense in many parts of the world.

Outlined here are country-specific projections up to the year 2100 for climate hazards under a 'business as usual' high emissions scenario compared to projections under a 'two-degree' scenario with rapidly decreasing global emissions. Most hazards caused by climate change will persist for many centuries.

COUNTRY-SPECIFIC CLIMATE HAZARD PROJECTIONS

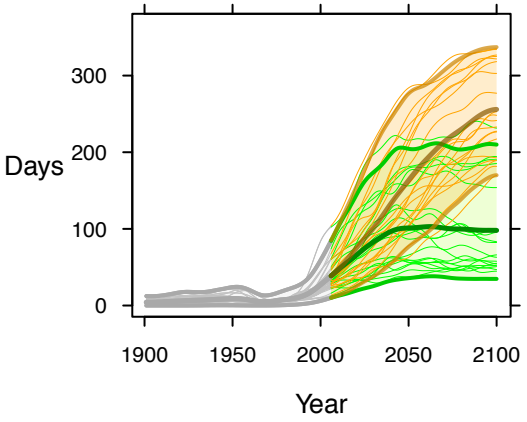
The model projections below present climate hazards under a high emissions scenario, Representative Concentration Pathway 8.5 [RCP8.5] (in orange) and a low emissions scenario, [RCP2.6] (in green).[a] The text boxes describe the projected changes averaged across about 20 models (thick line). The figures also show each model individually as well as the 90% model range (shaded) as a measure of uncertainty and, where available, the annual and smoothed observed record (in blue).[b,c]

MEAN ANNUAL TEMPERATURE



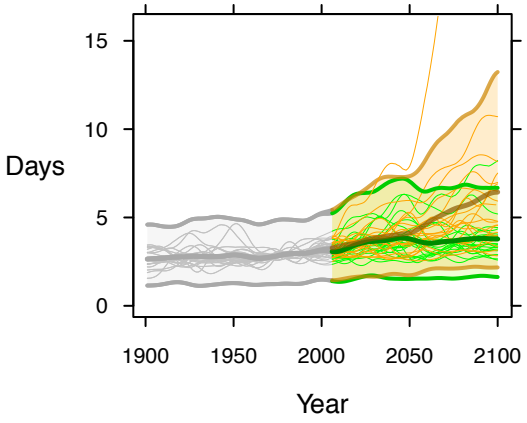
Under a high emissions scenario, mean annual temperature is projected to rise by about 4.5°C on average from 1990 to 2100. If emissions decrease rapidly, the temperature rise is limited to about 1.2°C.

DAYS OF WARM SPELL ('HEAT WAVES')



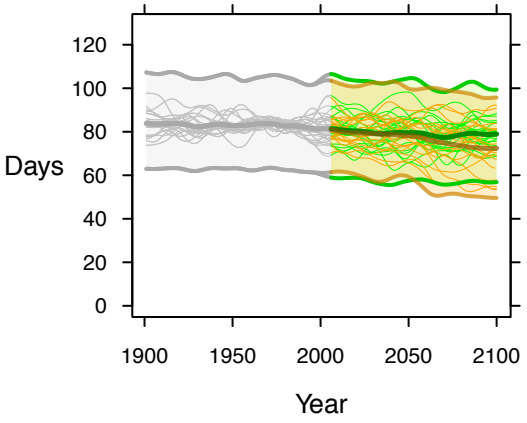
Under a high emissions scenario, the number of days of warm spell[d] is projected to increase from about 10 days in 1990 to about 250 days on average in 2100. If emissions decrease rapidly, the days of warm spell are limited to about 95 on average.

DAYS WITH EXTREME RAINFALL ('FLOOD RISK')



Under a high emissions scenario, the number of days with very heavy precipitation (20 mm or more) could double (an increase of about 3 days on average) from 1990 to 2100, increasing the risk of floods. Some models indicate increases well outside the range of historical variability, implying even greater risk. If emissions decrease rapidly, the increase in risk is much reduced.

CONSECUTIVE DRY DAYS ('DROUGHT')



Under a high emissions scenario, the longest dry spell is indicated to decrease from an average of about 80 days to about 70 days, with continuing large year-to-year variability. If emissions decrease rapidly, the decrease is limited to about 3 days on average.

a Model projections are from CMIP5 for RCP8.5 (high emissions) and RCP2.6 (low emissions). Model anomalies are added to the historical mean and smoothed.
b Observed historical record of mean temperature is from CRU-TSv.3.22.
c Analysis by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015.
d A 'warm spell' day is a day when maximum temperature, together with that of at least the 6 consecutive previous days, exceeds the 90th percentile threshold for that time of the year.

2 CURRENT AND FUTURE HEALTH RISKS DUE TO CLIMATE CHANGE

Human health is profoundly affected by weather and climate. Climate change threatens to exacerbate today's health problems – deaths from extreme weather events, cardiovascular and respiratory diseases, infectious diseases and malnutrition – whilst undermining water and food supplies, infrastructure, health systems and social protection systems.

EXPOSURE TO FLOODING DUE TO SEA LEVEL RISE

Severity of climate change scenario →

	Without Adaptation	With Adaptation
RCP2.6	300,000	500
RCP8.5	503,600	900

* Medium ice melting scenario ** Values rounded to nearest '00

In Kenya, under a high emissions scenario, and without large investments in adaptation, an annual average of about 503,600 people are projected to be affected by flooding due to sea level rise each year between 2070 and 2100. If global emissions decrease rapidly and there is a major scale up in protection (i.e. continued construction/raising of dikes) the annual affected population could be limited to about 500 people. Adaptation alone will not offer sufficient protection, as sea level rise is a long-term process, with high emissions scenarios bringing increasing impacts well beyond the end of the century.

Source: Human dynamics of climate change, technical report, Met Office, HM Government, UK, 2014.

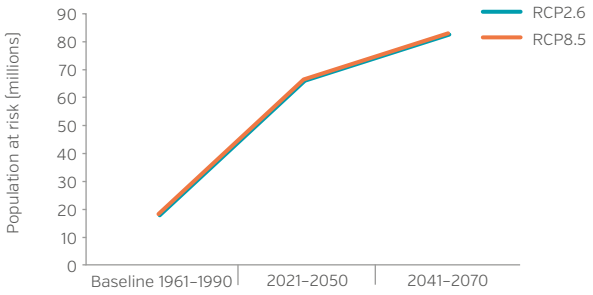
KEY IMPLICATIONS FOR HEALTH

Kenya also faces inland river flood risk. It is projected, that by 2030, an additional 75,100 people may be at risk of river floods annually as a result of climate change and 36,700 due to socio-economic change above the estimated 29,600 annually affected population in 2010.[a]

In addition to deaths from drowning, flooding causes extensive indirect health effects, including impacts on food production, water provision, ecosystem disruption, infectious disease outbreak and vector distribution. Longer term effects of flooding may include post-traumatic stress and population displacement.

INFECTIOUS AND VECTOR-BORNE DISEASES

Population at risk of malaria in Kenya (in millions)



Towards 2070, under both high and low emissions scenarios about 83 million people are projected to be at risk of malaria. Population growth can also cause increases in the population at-risk in areas where malaria presence is static in the future.

Source: Rocklöv, J., Quam, M. et al. 2015.[d]

Mean relative vectorial capacity for dengue fever transmission

The mean relative vectorial capacity for dengue fever transmission is projected to increase slightly towards 2070 under both a high and low emissions scenario, reaching from about 0.59 on average during the baseline period of 1961–1990 to about 0.68 under a high emissions scenario (figure not shown).

Source: Rocklöv, J., Quam, M. et al. 2015.[d]

KEY IMPLICATIONS FOR HEALTH

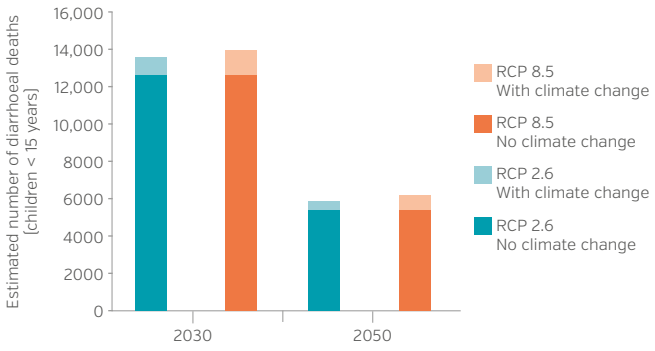
Some of the worlds most virulent infections are also highly sensitive to climate: temperature, precipitation and humidity have a strong influence on the life-cycles of the vectors and the infectious agents they carry and influence the transmission of water and food-borne diseases.[b]

Socioeconomic development and health interventions are driving down burdens of several infectious diseases, and these projections assume that this will continue. However, climate conditions are projected to become significantly more favourable for transmission, slowing progress in reducing burdens, and increasing the populations at risk if control measures are not maintained or strengthened.[c]

a World Resources Institute, http://www.wri.org. Aqueduct Global Flood Analyzer. Assumes continued current socio-economic trends (SSP2) and a 25-year flood protection.
b Atlas of Health and Climate, World Health Organization and World Meteorological Organization, 2012
c Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.
d Country-level analysis, completed in 2015, was based on health models outlined in the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014. The mean of impact estimates for three global climate models are presented. Models assume continued socioeconomic trends (SSP2 or comparable).

INFECTIOUS AND VECTOR-BORNE DISEASES

Estimated number of deaths due to diarrhoeal disease in children under 15 yrs in Kenya (base case scenario for economic growth)

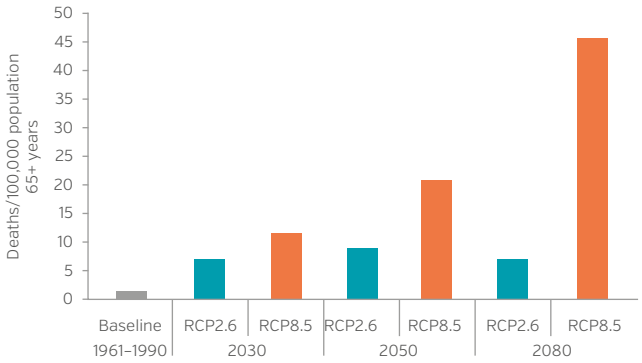


In the baseline year of 2008 there were an estimated 23,500 diarrhoeal deaths in children under 15 years old. Under a high emissions scenario, diarrhoeal deaths attributable to climate change in children under 15 years old are projected to be about 9.1% of approximately 13,800 diarrhoeal deaths projected in 2030. Although diarrhoeal deaths are projected to decline to about 6,200 by 2050 the proportion of deaths attributable to climate change may rise to about 13%.

Source: Lloyd, S., 2015.[a]

HEAT-RELATED MORTALITY

Heat-related mortality in population 65 years or over, Kenya (deaths / 100,000 population 65+ yrs)



Under a high emissions scenario heat-related deaths in the elderly (65+ years) are projected to increase to about 45 deaths per 100,000 by 2080 compared to the estimated baseline of under 2 deaths per 100,000 annually between 1961 and 1990. A rapid reduction in emissions could limit heat-related deaths in the elderly to about 7 deaths per 100,000 in 2080.

Source: Honda et al., 2015.[a]

KEY IMPLICATIONS FOR HEALTH

Climate change is expected to increase mean annual temperature and the intensity and frequency of heat waves resulting in a greater number of people at risk of heat-related medical conditions.

The elderly, children, the chronically ill, the socially isolated and at-risk occupational groups are particularly vulnerable to heat-related conditions.

UNDERNUTRITION

Climate change, through higher temperatures, land and water scarcity, flooding, drought and displacement, negatively impacts agricultural production and causes breakdown in food systems. These disproportionally affect those most vulnerable to hunger and can lead to food insecurity. Vulnerable groups risk further deterioration into food and nutrition crises if exposed to extreme climate events.[b]

Without considerable efforts made to improve climate resilience, it has been estimated that the global risk of hunger and malnutrition could increase by up to 20 percent by 2050.[b]

In Kenya, the prevalence of stunting in children under age 5 was 35.2% in 2009, the prevalence of underweight children and wasting in children under 5 was 16.4% and 7.0%, respectively, in 2009.[c]

a Country-level analysis, completed in 2015, was based on health models outlined in the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014. The mean of impact estimates for three global climate models are presented. Models assume continued socioeconomic trends (SSP2 or comparable).
b World Food Project 2015 https://www.wfp.org/content/two-minutes-climate-change-and-hunger
c World Health Organization, Global Database on Child Growth and Malnutrition [2015 edition]. Please see source for definition of child malnutrition measures.

3 CURRENT EXPOSURES AND HEALTH RISKS DUE TO AIR POLLUTION

Many of the drivers of climate change, such as inefficient and polluting forms of energy and transport systems, also contribute to air pollution. Air pollution is now one of the largest global health risks, causing approximately seven million deaths every year. There is an important opportunity to promote policies that both protect the climate at a global level, and also have large and immediate health benefits at a local level.

OUTDOOR AIR POLLUTION EXPOSURE

KEY IMPLICATIONS FOR HEALTH

Outdoor air pollution can have direct and sometimes severe consequences for health.

Fine particles which penetrate deep into the respiratory tract subsequently increase mortality from respiratory infections, lung cancer and cardiovascular disease.

Short lived climate pollutants (SLCPs) such as black carbon, methane and tropospheric ozone are released through inefficient use and burning of biomass and fossil fuels for transport, housing, power production, industry, waste disposal (municipal and agricultural) and forest fires. SLCPs are responsible for a substantial fraction of global warming as well as air-pollution related deaths and diseases. Since short lived climate pollutants persist in the atmosphere for weeks or months while CO_2 emissions persist for years, significant reductions of SLCP emissions could reap immediate health benefits and health cost savings,[a] and generate very rapid climate benefits – helping to reduce near-term climate change by as much as 0.5°C before 2050.[a]

In Kenya, it is projected that a reduction in SLCPs* could prevent about 10,400 premature deaths per year from outdoor air pollution from 2030 onwards (Source: Shindell, D., Science, 2012).

* Through implementation of 14 reduction measures: 7 targeting methane emissions and the rest, emissions from incomplete combustion. See source for further detail.

Note: Data on outdoor air pollution ($PM_{2.5}$) in Kenyan cities was not available in the WHO Ambient Air Pollution Database (WHO, 2014).

HOUSEHOLD AIR POLLUTION

KENYA

Percentage of population primarily using solid fuels for cooking (%), 2013

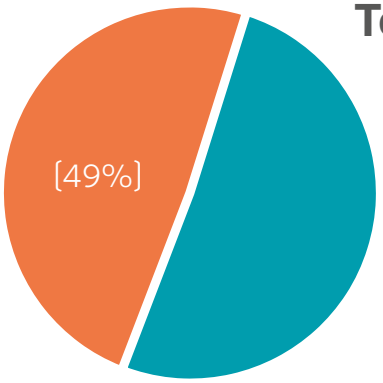
RURAL AREAS
>95

URBAN AREAS
51

NATIONAL TOTAL
84

Source: Global Health Observatory, data repository, World Health Organization, 2013.

Percent of total deaths from ischaemic heart disease, stroke, lung cancer, chronic obstructive pulmonary disease (18 years +) and acute lower respiratory infections (under 5 years) attributable to household air pollution, 2012.



Total Deaths: 44,000

Attributable to household air pollution

Source: Global Health Observatory, data repository, World Health Organization, 2012.

KEY IMPLICATIONS FOR HEALTH

Air pollution in and around the home is largely a result of the burning of solid fuels (biomass or coal) for cooking.

Women and children are at a greater risk for disease from household air pollution. Consequently, household air pollution is responsible for a larger proportion of the of total number of deaths from ischaemic heart disease, stroke, lung cancer and COPD in women compared to men.[b]

In Kenya, 59% percent of an estimated 19,000 child deaths due to acute lower respiratory infections is attributable to household air pollution (WHO, 2012).

a United Nations Environment Programme. Reducing Climate-related Air Pollution and Improving Health: Countries can act now and reap immediate benefits. http://www.unep.org/ccac/Media/PressReleases/ReducingClimate-relatedAirPollution/tabid/131802/language/en-US/Default.aspx

b Annu. Rev. Public. Health. 2014.35:185-206. http://www.who.int/phe/health_topics/outdoorair/databases/HAP_BoD_results_March2014.pdf?ua=1

4 CO-BENEFITS TO HEALTH FROM CLIMATE CHANGE MITIGATION: A GLOBAL PERSPECTIVE

Health co-benefits are local, national and international measures with the potential to simultaneously yield large, immediate public health benefits and reduce the upward trajectory of greenhouse gas emissions. Lower carbon strategies can also be cost-effective investments for individuals and societies.

Presented here are examples, from a global perspective, of opportunities for health co-benefits that could be realised by action in important greenhouse gas emitting sectors.[a]

Transport

Transport injuries lead to 1.2 million deaths every year, and land use and transport planning contribute to the 2–3 million deaths from physical inactivity. The transport sector is also responsible for some 14% (7.0 $GtCO_2e$) of global carbon emissions. The IPCC has noted significant opportunities to reduce energy demand in the sector, potentially resulting in a 15%–40% reduction in CO_2 emissions, and bringing substantial opportunities for health: A modal shift towards walking and cycling could see reductions in illnesses related to physical inactivity and reduced outdoor air pollution and noise exposure; increased use of public transport is likely to result in reduced GHG emissions; compact urban planning fosters walkable residential neighborhoods, improves accessibility to jobs, schools and services and can encourage physical activity and improve health equity by making urban services more accessible to the elderly and poor.

Electricity Generation

Reliable electricity generation is essential for economic growth, with 1.4 billion people living without access to electricity. However, current patterns of electricity generation in many parts of the world, particularly the reliance on coal combustion in highly polluting power plants contributes heavily to poor local air quality, causing cancer, cardiovascular and respiratory disease. Outdoor air pollution is responsible for 3.7 million premature deaths annually, 88% of these deaths occur in low and middle income countries. The health benefits of transitioning from fuels such as coal to lower carbon sources, including ultimately to renewable energy, are clear: Reduced rates of cardiovascular and respiratory disease such as stroke, lung cancer, coronary artery disease, and COPD; cost-savings for health systems; improved economic productivity from a healthier and more productive workforce.

Household Heating, Cooking and Lighting

Household air pollution causes over 4.3 million premature deaths annually, predominantly due to stroke, ischaemic heart disease, chronic respiratory disease, and childhood pneumonia. A range of interventions can both improve public health and reduce household emissions: a transition from the inefficient use of solid fuels like wood and charcoal, towards cleaner energy sources like liquefied petroleum gas (LPG), biogas, and electricity could save lives by reducing indoor levels of

Healthcare Systems

Health care activities are an important source of greenhouse gas emissions. In the US and in EU countries, for example, health care activities account for between 3–8% of greenhouse gas (CO_2-eq) emissions. Major sources include procurement and inefficient energy consumption. Modern, on-site, low-carbon energy solutions (e.g. solar, wind, or hybrid solutions) and the development of combined heat and power generation capacity in larger facilities offer significant potential to lower the health sector's carbon