CLIMATE AND HEALTH COUNTRY PROFILE – 2015
BOTSWANA

World Health Organization

United Nations Framework Convention on Climate Change

OVERVIEW

The landlocked Republic of Botswana in southern Africa is semi-arid, with a short rainy season. Botswana is affected by periodic droughts and winds which carry dust and sand during the dry season. Desertification and limited fresh water resources are environmental threats facing Botswana.

Upon independence in 1966, Botswana was one of the poorest countries in the world, but its economy has since been one of the fastest growing in the world [World Bank Country Overview, 2016]. However, high rates of poverty in remote areas, income inequality and a high HIV/AIDS adult prevalence rate are still issues impacting population health and well-being [World Bank Country Overview, 2016].

Droughts and rainfall variability are predicted to increase with climate change [Botswana INDC, 2015]. Slowed agricultural production, increasing food insecurity and increased water stress have already been witnessed, and are likely to continue. Extreme events associated with climate change are likely to lead to an increased incidence of vector-borne diseases such as malaria and Bilharzia [Botswana INDC, 2015].

The government of Botswana is working to address such risks - Botswana is developing a Climate Change Policy and Institutional Framework which will be supported by a Strategy and Action Plan to operationalize the Policy [to be approved in 2016]. Botswana aims to ensure the Policy is implementable by developing a comprehensive package of measures including, a long-term low carbon strategy, a national adaptation plan, nationally appropriate mitigation actions, identification of key technologies, a plan for knowledge management capacity development, education and public awareness and a financial mechanism [Botswana INDC, 2015].

SUMMARY OF KEY FINDINGS

- In Botswana, under a high emissions scenario, mean annual temperature is projected to rise by about 6.2°C on average from 1990 to 2100. If global emissions decrease rapidly, the temperature rise is limited to about 1.7°C [page 2].
- In Botswana, under a high emissions scenario, the number of days of warm spell[a] is projected to increase from less than 10 days in 1990 to about 240 days on average in 2100. If global emissions decrease rapidly, the days of warm spell[a] are limited to about 50 on average [page 2].
- In Botswana, the risk of malaria is projected to increase under a high emissions scenario [page 3].
- In Botswana, under a high emissions scenario heat-related deaths in the elderly [65+ years] are projected to increase to about 136 deaths per 100,000 by 2080 compared to the estimated baseline of approximately 3 deaths per 100,000 annually between 1961 and 1990. A rapid reduction in global emissions could limit heat-related deaths in the elderly to about 20 deaths per 100,000 in 2080.

OPPORTUNITIES FOR ACTION

Botswana has an approved national health adaptation strategy and a national strategy on climate change mitigation that includes health implications of mitigation action. Country reported data [see section 6] indicate that there are further opportunities for action in the following areas:

1) Adaptation

- Conduct a national assessment of climate change impacts, vulnerability and adaptation for health.
- Implement projects on health adaptation to climate change.
- Take action to build institutional and technical capacities to work on climate change and health
- Include estimated costs to implement health resilience to climate change in planned allocations.

2) Mitigation

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

3) National Policy Implementation

- Identify a national focal point for climate change in the Ministry of Health or relevant government institution with a clear role and responsibilities.

DEMOGRAPHIC ESTIMATES	
Population [2013][b]	2.18 million
Population growth rate [2013][b]	2.0 %
Population living in urban areas [2013][c]	56.9 %
Population under five [2013][b]	11.8 %
Population aged 65 or over [2013][b]	3.5 %
ECONOMIC AND DEVELOPMENT INDICATORS	
GDP per capita [current US$, 2013][d]	6882 USD
Total expenditure on health as % of GDP [2013][e]	5.4 %
Percentage share of income for lowest 20% of population [2010][d]	NA
HDI [2013, +/- 0.01 change from 2005 is indicated with arrow][f]	0.683 ▲
HEALTH ESTIMATES	
Life expectancy at birth [2013][g]	64 years
Under-5 mortality per 1000 live births [2013][h]	47

a 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.
b World Population Prospects: The 2015 Revision, UNDESA [2015]
c World Urbanization Prospects: The 2014 Revision, UNDESA [2014]
d World Development Indicators, World Bank [2016]
e Global Health Expenditure Database, WHO [2014]
f United Nations Development Programme, Human Development Reports [2014]
g Global Health Observatory, WHO [2014]
h Levels & Trends in Child Mortality Report 2015, UN Inter-agency Group for Child Mortality Estimation [2015]

1 CURRENT AND FUTURE CLIMATE HAZARDS

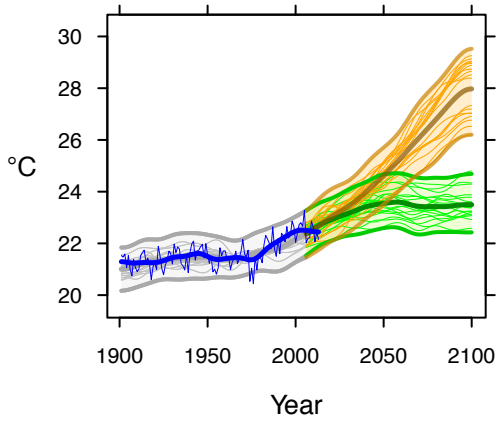
Due to climate change, many climate hazards and extreme weather events, such as heat waves, heavy rainfall and droughts, could become more frequent and more intense in many parts of the world.

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

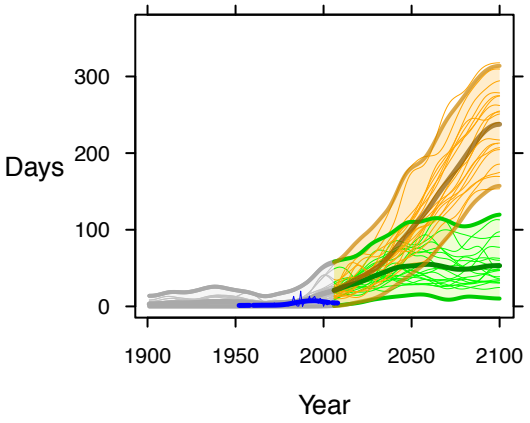
The model projections below present climate hazards under a high emissions scenario, Representative Concentration Pathway 8.5 [RCP8.5] (in orange) and a low emissions scenario, [RCP2.6] (in green).[a] The text boxes describe the projected changes averaged across about 20 models (thick line). The figures 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



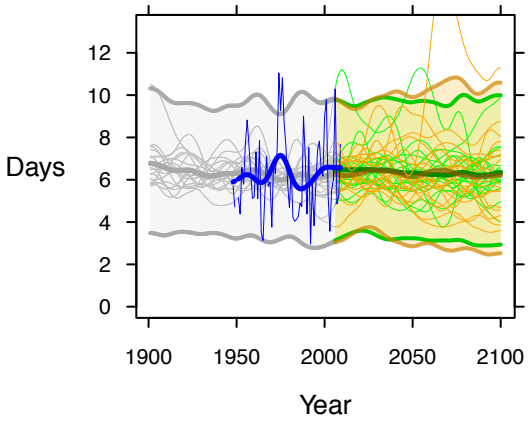
Under a high emissions scenario, mean annual temperature is projected to rise by about 6.2°C on average from 1990 to 2100. If emissions decrease rapidly, the temperature rise is limited to about 1.7°C.

DAYS OF WARM SPELL ('HEAT WAVES')



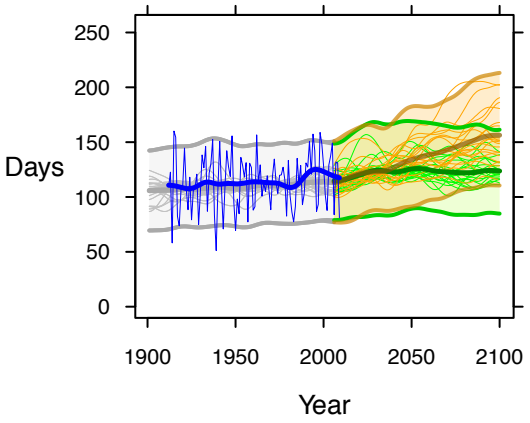
Under a high emissions scenario, the number of days of warm spell[d] is projected to increase from less than 10 days in 1990 to about 240 days on average in 2100. If emissions decrease rapidly, the days of warm spell are limited to about 50 on average.

DAYS WITH EXTREME RAINFALL ('FLOOD RISK')



Under both high and low emissions scenarios, the number of days with very heavy precipitation (20 mm or more) is not expected to change much on average from 1990 to 2100. Year-to-year variability is high, but the total number of such days (about 6) generally remains low.

CONSECUTIVE DRY DAYS ('DROUGHT')



Under a high emissions scenario, the longest dry spell could increase from about 110 days to about 150 days on average, suggesting greater persistence of droughts, with continuing large year-to-year variability. If emissions decrease rapidly, the increase is limited to about 10 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; observed historical records of extremes are from HadEX2.
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.

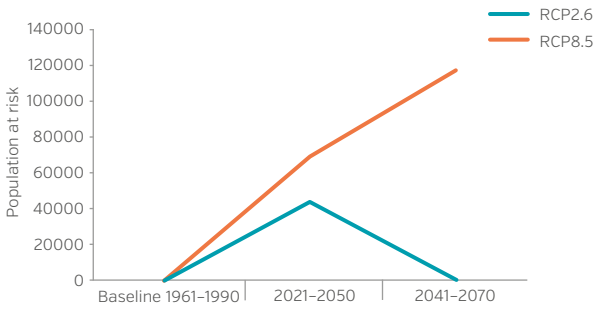
WATER, HEALTH AND AGRICULTURE

KEY IMPLICATIONS FOR HEALTH

Water scarcity is already a serious issue facing Botswana. Groundwater is the main source of potable water supply and increasing demand for industrial, mining, agricultural and domestic uses are leading to even more stress on limited water resources.[a] With climate change, Botswana is also facing increasing variabilty in rainfall and persistent drought conditions most heavily impacting the south-western region.[a] Consequently, a lack of safe water supply and losses in livestock and agricultural production jeopardize health through food insecurity, famine and disease. In recognizing that drought affects all sectors, the Government of Botswana has initiated adaptation strategies to manage the impacts of drought and promote sustainability with emphasis on the the water, health and agriculture (crop and livestock) sectors. (Botswana INDC, 2015).

INFECTIOUS AND VECTOR-BORNE DISEASES

Population at risk of malaria in Botswana



Under a high emissions scenario, the population at risk of malaria will continue to increase towards 2070. By contrast, if global emissions decline rapidly, the population at risk will increase towards 2050 but then the risk will steadily decrease towards 2070. It should be noted, that due to the specifications of the global model, the population at risk in Botswana is estimated at zero in the baseline period, even though transmission does occur, and the country is particularly subject to epidemics. This illustrates that Botswana is at the margins of transmission, and therefore particularly susceptible to changes in environmental conditions. Although the values of population at risk may differ from other model estimates of population at risk in Botswana, the key finding is the difference in trend observed between a high emissions scenario (continual increase in malaria risk) versus a low emissions scenario (malaria risk increases until global emissions stabilize and then declines).[d]

Additionally, malaria infection in Botswana is unstable and epidemics are influenced by periods of heavy rainfall.[a] Climate change with increased variability in rainfall and extreme weather events may also impact the geographic and seasonal distribution of malaria risk in Botswana.

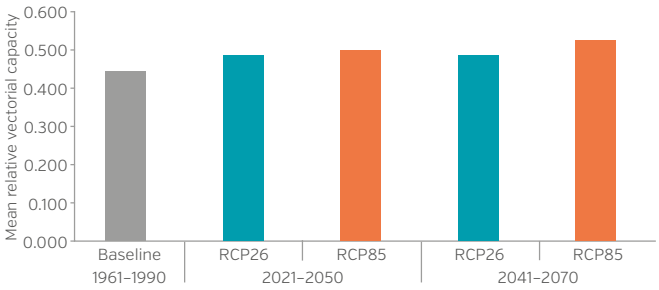
KEY IMPLICATIONS FOR HEALTH

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 Republic of Botswana, Second National Communication to the United Nations Framework Convention on Climate Change, Ministry of Environment, Wildlife and Tourism, December 2011.
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 Rocklöv, J., Quam, M. et al., 2015. 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).

Mean relative vectorial capacity for dengue fever transmission in Botswana

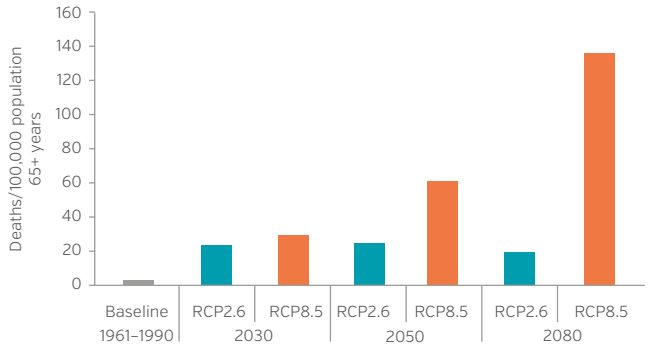


Under a high emissions scenario, the mean relative vectorial capacity for dengue fever transmision is projected to increase to about 0.52 from the baseline value of 0.45. A rapid decline in global emissions could limit the rise of mean vectorial capacity for dengue fever transmission to a value of about 0.49.

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

HEAT-RELATED MORTALITY

Heat-related mortality in population 65 years or over, Botswana (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 136 deaths per 100,000 by 2080 compared to the estimated baseline of approximately 3 deaths per 100,000 annually between 1961 and 1990. A rapid reduction in emissions could limit heat-related deaths in the elderly to about 20 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 people at risk 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 Botswana, the prevalence of stunting in children under age 5 was 31.4% in 2008, the prevalence of underweight children and wasting in children under 5 was 11.2% and 7.2%, respectively, in 2008.[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 and 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 definitions 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.

Outdoor air pollution data was not available for Botswana according to the WHO ambient air pollution database (2016).

HOUSEHOLD AIR POLLUTION

BOTSWANA

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

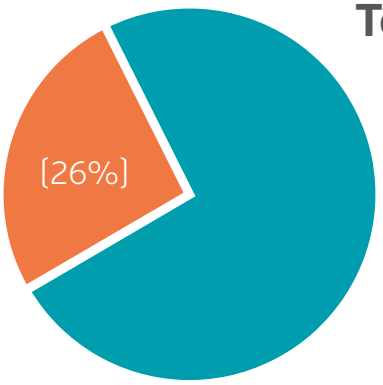
RURAL AREAS
65

URBAN AREAS
15

NATIONAL TOTAL
37

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: 2,300

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.[a]

In Botswana, 40% percent of an estimated 330 child deaths due to acute lower respiratory infections is attributable to household air pollution (WHO, 2012).

a 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