World Health Organization

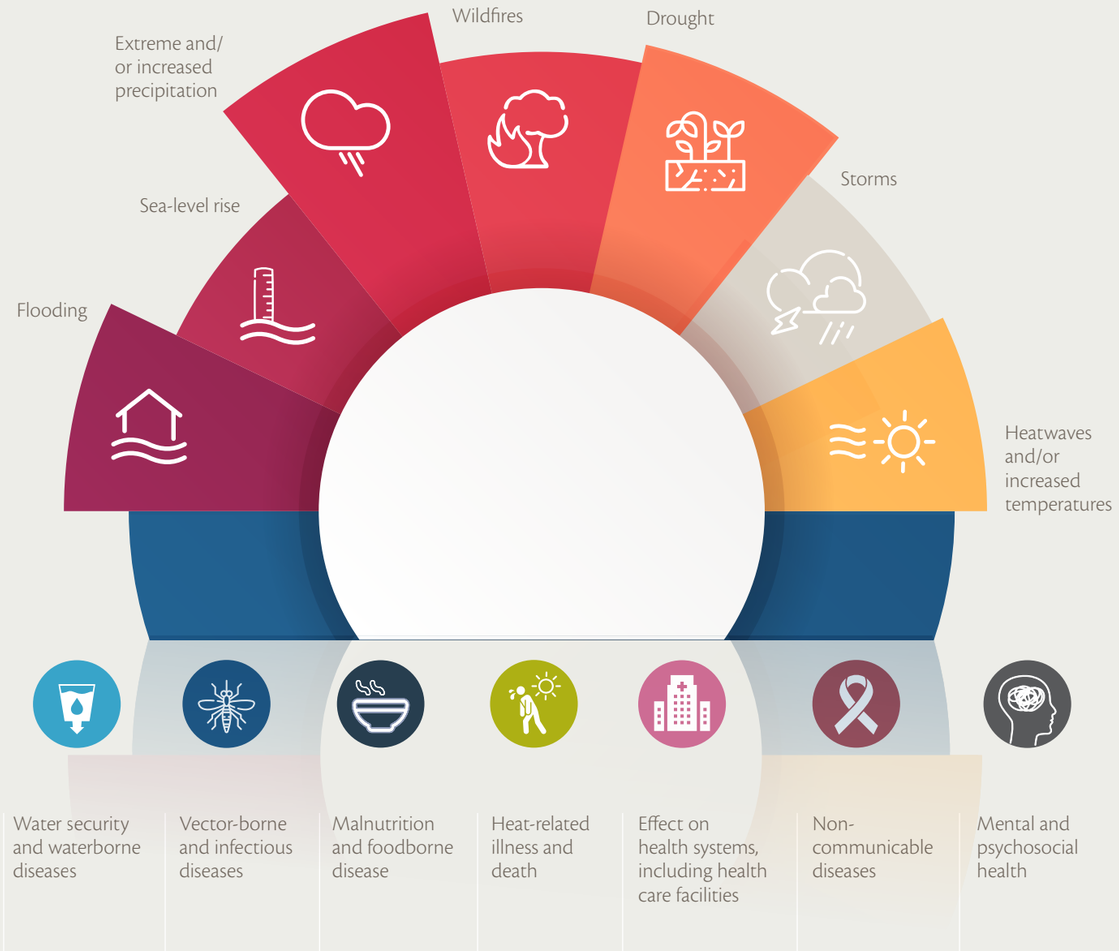
Developed in collaboration with the Kisumu County Government

2022

HEALTH AND CLIMATE CHANGE URBAN PROFILE
Kisumu County

This World Health Organization (WHO) health and climate change urban profile presents a snapshot of key climate hazards, climate-sensitive health risks, and the potential health benefits of climate change adaptation and mitigation. The profile does not provide comprehensive information on all climate hazards, vulnerability factors or health risks but rather provides examples of some immediate risks based on available evidence and reported priorities and initiatives. Outlined in this profile are opportunities to promote policies and projects that protect the climate and environment while having large immediate health benefits at a local level. This profile captures the entirety of Kisumu County, which includes the city of Kisumu and the encompassing area.

Climate hazards and health risks *(1, 2, 3)*



Health and development indicators

1.15 million population

In 2019, Kisumu County had a population of 1 155 574 with a land area of 2085km^2 *(4)*.

19%

Malaria prevalence in Kisumu County has dropped from 27% in 2015 to 19% in 2021 following targeted measures to tackle the disease *(5)*.[1]

Top 10

Diarrheal diseases were among the top 10 leading causes of death in Kisumu in 2019 *(6)*.

[1] The drop in prevalence was attributed to targeted measures, including, successful mass distribution of insecticide treated nets, accurate diagnosis and treatment of the disease and vector control rolled out by the government and development partners as reported by the Kisumu County Malaria Control Programme.

Evidence to support

Water security and waterborne diseases

- Almost 90% of residents rely on open water sources. Flooding, due to variable rainfall patterns and rising lake levels, negatively impacts the quality of water sources *(3)*.
- Increasingly unsafe and/ or insecure drinking water and sanitation services due to climate variability and climate change could lead to increases in cholera and other waterborne diseases and deaths *(7, 8)*.
- In Kisumu, diarrhoeal diseases are already among the top 10 leading causes of death *(6)*. Kisumu's informal settlements, which have poor sanitation systems and lack easy access to health care facilities, are particularly at risk of waterborne diseases *(9)*.

Malnutrition and foodborne diseases

- Agricultural losses due to the increasing frequency of flood and drought events present a major obstacle in alleviating food insecurity and poverty *(10)*.
- Flood- and drought-related crop failures are three times higher in Kisumu County compared with other regions and cost households an average of US$ 2000 annually *(10, 11)*.
- Both acute and prolonged food insecurity put children at risk of stunting and chronic illness; in 2015, stunting rates in children under 5 years old in Kisumu County were around 18% *(6, 12)*.
- Malnutrition is a leading cause of death and disease in the county (2019) *(8, 12)*.

Vector-borne and infectious diseases

- Kisumu is an endemic zone for malaria due to its location in the Lake Victoria Basin *(8)*.
- The lake endemic zone has the highest malaria prevalence among children aged 6 months to 14 years, 19% compared with the national average of 6% in 2020 *(13)*.
- Increasing temperatures (with a projected increase of 1 to 3˚C by 2050[2] *(14)* and rainfall in Western Kenya are expected to lead to enhanced conditions for mosquito-borne diseases, potentially leading to epidemics of malaria and dengue as well as outbreaks of Rift Valley Fever *(7, 15, 16)*.

Air pollution[3]

26,6 µg/m^3 $PM_{2.5}$

Kenya's national mean annual PM2.5 concentration was 26,6 µg/m^3 in 2016 *(17)*. This is well above the WHO air quality guideline value of 5 µg/m^3 *(18)*.

17%

Proportion of Kenyan population with primary reliance on clean fuels and technologies for cooking in 2019. Household air pollution from unclean sources of energy in homes causes serious health consequences *(19)*.

Air pollution 3rd leading risk factor

As of 2021 in Kisumu County, air pollution was the 3rd leading risk factor driving death and disease *(8)*.

BreatheLife City[4] - ✗

Kisumu is not part of the BreatheLife global campaign to mobilize cities to protect health and the planet from the effects of air pollution *(20)*.

[2] Baseline is average observed annual temperatures from 1979 to 2000. Modelled projections are for representative concentration pathways (RCP) 4.5 and 8.5.
[3] Many of the drivers of climate change, such as inefficient and polluting forms of energy and transport systems, also contribute to air pollution.
[4] The BreatheLife Network and global campaign is a collaboration between WHO, the Climate and Clean Air Coalition, the United Nations Environment Programme, and the World Bank.

Emissions

Emissions inventory

Under development
In 2021–2022, the Kisumu County government committed to carrying out a baseline emissions inventory as part of the county's roadmap for reducing greenhouse gas (GHG) emissions within the county *(21)*.

Climate and health commitments

Climate change assessments and plans	Completed?	Health included?
Climate risk and vulnerability assessment	✓	✓
Adaptation plan	**In progress**	**N/A**
Mitigation plan	**In progress**	**N/A**

Climate change and health initiatives	
Climate change bill to provide a framework for funding adaptation activities	✓ **(passed in 2020)**
Global Covenant of Mayors for Climate & Energy	✓
Kenya Climate Smart Agriculture Project	✓
Water security target	✓ **(80% of county has access to safe drinking water within the county (current level is 42%) *(10)***

Adaptation and mitigation actions

Flooding

- Based on the County Integrated Development Plan, the city has started implementing a four-year project to improve and install storm-water drainage *(1)*.
- This measure is expected to reduce latrine overflows during floods and protect clean-water sources *(1, 22)*.
- The county has formulated flood hazard maps for the entire city, which are currently undergoing validation through a participatory community approach *(1, 22)*.

Drought

- Several water management projects are already underway, including promoting rainwater harvesting systems, increasing water storage capacity in rural areas from 5800 m^3 to 35 000 m^3, drilling and equipping new boreholes, and desilting existing water pans to improve storage and holding capacity *(1, 22)*.
- New storage capacities will provide stored water during periods of drought and reduce the number of stagnant water sources that could serve as malaria breeding grounds *(1, unpublished data)*.

Heat stress

- Kisumu County is aiming to increase its forest cover from 0.5% to 10% by 2022 by planting 40 million seedlings *(1, 23)*. Increased tree coverage will provide invaluable shade for outdoor workers during hot days.
- As well as planting pioneer tree species in water sheds for water preservation *(23, 24)*, the city is collaborating with industries on reforestation *(23)*.

Benefits to health

Flooding

Improved storm and rainwater drainage helps to *(22, 25)*:

- reduce the number of injuries and deaths due to flooding.
- limit the spread of waterborne diseases and infections associated with unsafe water quantity and quality; reduce the risk of vector-borne diseases, such as malaria, by avoiding stagnant open water.
- avoid the mental health stresses associated with extreme weather events.
- limit disruption to health services.

Drought

- Improving and expanding the rainwater harvesting system and increasing water storage capacity has positive impacts on drinking water supplies and sanitation services. This helps to limit morbidity and mortality associated with unsafe water and sanitation services.
- By helping to develop a reliable water supply for crops and livestock, it may contribute to reduced climate-induced migration from rural to urban areas *(25–27)*.
- A study in Kenya evaluated that safe Water System (SWS), such as chlorinating stored water, latrine presence and use of rainwater sources, could reduce the risk of diarrhoea in children under 5 years old by 65% compared with households where the system is not in use *(28)*.

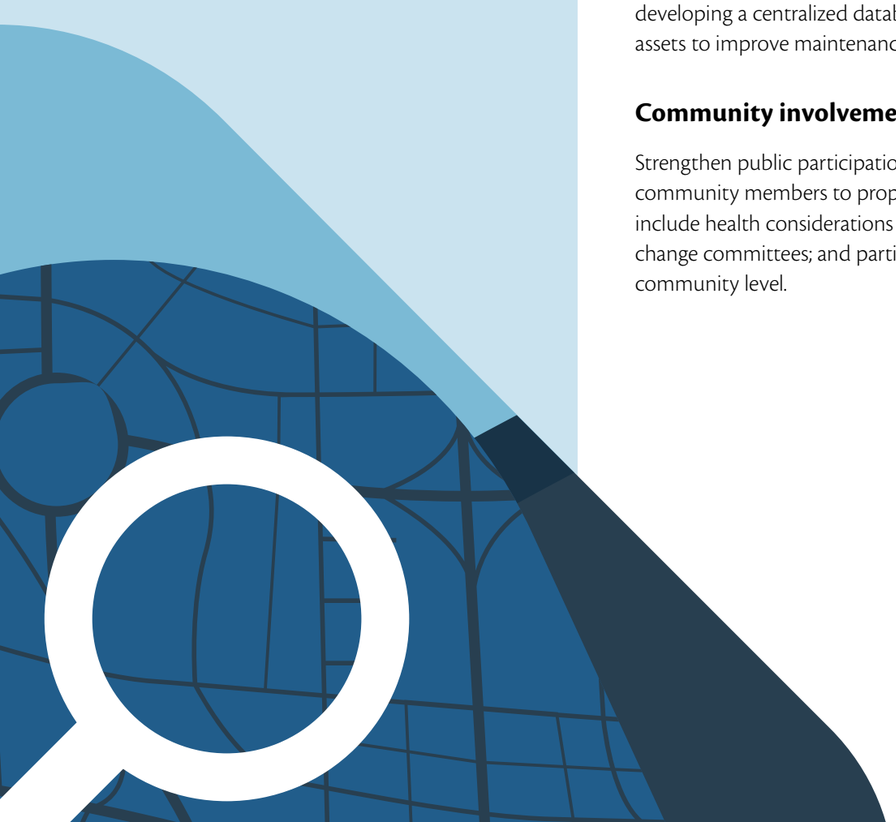
Heat stress

- Increasing forest coverage has positive effects on lowering the local air temperatures and reducing the incidence of cardiovascular diseases, respiratory diseases, heat exhaustion, heat stroke and overall heat-related mortality *(25–27)*.
- Benefits for mental health are observed with an increase in tree coverage *(27)*.

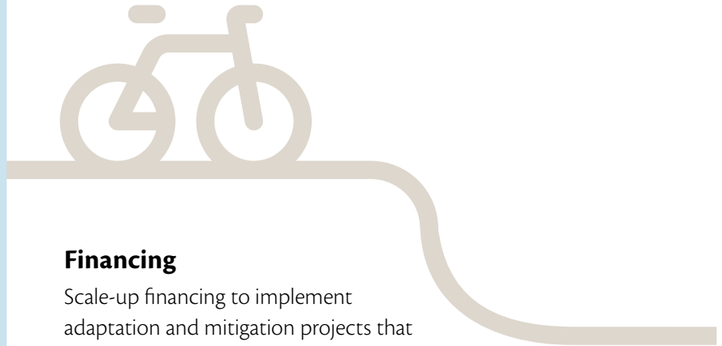
City zoom-in

Solid waste management in Kisumu

Kisumu's urban centre is experiencing rapid urbanization and population pressures. This puts additional pressure on critical infrastructure and systems that support public health, including the already stressed waste management system *(15, 29, 30)*. Only 25% to 30% of solid waste is formally collected in the county, leaving the rest to be dumped in the streets or latrines, blocking storm drains, or burnt *(31)*. Dumping in landfills and waste burning contribute to GHG emissions and increase $PM^{2.5}$ concentrations *(32, 33)*. In 2020, the total CO_2eq emissions from waste in Kisumu were estimated at over 40 000 tonnes per year *(33)*. Additionally, Kisumu's informal settlements are particularly vulnerable as they receive little or no collection services from the city, leading to waste pits that harbour diseases *(29)*.



Calls for action



Financing

Scale-up financing to implement adaptation and mitigation projects that are currently under-budgeted (33). This will contribute to protecting population health from climate risks *(34)*. Key projects for investment include water management initiatives; improvements to water distribution pipelines and waste management; and construction of a sanitary landfill *(1)*.

Collaborations

Kisumu County is a member of the Lake Region Economic Bloc, which could fund and develop large cross-county health adaptation and mitigation projects *(35)* such as developing a centralized database for health infrastructure assets to improve maintenance and performance.

Community involvement

Strengthen public participation through: forums with community members to propose adaptation projects that include health considerations and equity; ward climate change committees; and participatory scenario planning at community level.

References

1. CDP Open Data Portal [online database]. London: CDP; 2021 (https://data.cdp.net/, accessed 12 July 2021).
2. Climate risk profile: Kenya. United States Agency for International Development; 2018 (https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Kenya.pdf, accessed 12 July 2021).
3. Climate risk profile for Kisumu County. Kenya climate risk profile series. Nairobi: The Kenya Ministry of Agriculture, Livestock and Fisheries; 2018 (https://hdl.handle.net/10568/96293, accessed 7 July 2021).
4. 2019 Kenya Population and Housing Census Volume I: Population by County and Sub-County as found in openAFRICA [website] (https://wwwknbsorke/?wpdmpro=2019-kenya-population-and-housing-census-volume-i-population-by-county-and-sub-county, accessed on May 19, 2022).
5. Kenya News Agency, 2021. Malaria Prevalence in Kisumu Drops by 8pc in 2021, https://www.kenyanews.go.ke/malaria-prevalence-in-kisumu-drops-by-8pc-in-2021/#:~:text=Malaria%20prevalence%20in%20Kisumu%20County,to%20tame%20the%20killer%20disease, accessed May 19, 2022). As data provided in https://dhsprogram.com/publications/publication-MIS22-MIS-Final-Reports.cfm and https://dhsprogram.com/publications/publication-MIS36-MIS-Final-Reports.cfm.
6. Kenya – Kisumu profile [online database]. Seattle, WA: Institute for Health Metrics and Evaluation, University of Washington; 2021 (http://www.healthdata.org/kenya-kisumu, accessed 2 August 2021).
7. Ofulla A, Gichere S, Olado G, Aboum P, Anyona D, Othero D, et al. Effects of regional climate variability on the prevalence of diseases and their economic impacts on households in the Lake Victoria Basin of Western Kenya. Int J Global Warming. 2016;10:332 (http://dx.doi.org/10.1504/IJGW.2016.077899, accessed 16 July 2021).
8. Songa JW. Climate change and vector borne diseases: the case of malaria in Kenya. Pinnacle Med & Med Sci. 2015;2(5) (http://pjpub.org/pmms/pmms_197.pdf, accessed 4 August 2021).
9. Situational analysis of informal settlements in Kisumu. Nairobi: UN Human Settlements Programme; 2005 (https://scarp.ubc.ca/sites/scarp.ubc.ca/files/situational%20analysis%20of%20informal%20settlements%20in%20Kisumu.pdf, accessed 4 August 2021).
10. Briefing note: Kenya drought profile. ACAPS; 2019 (https://www.acaps.org/sites/acaps/files/products/files/20190604_start_acaps_kenya_drought.pdf, accessed 22 July 2021).
11. Nelson O. Food poverty in Kisumu, Kenya. In: Battersby J and Watson V. Urban food systems governance and poverty in African cities. London and New York: Routledge; 2018:223–235.
12. Kisumu County: health at a glance. Washington DC: Health Policy Project; 2015 (https://www.healthpolicyproject.com/pubs/291/Kisumu%20County-FINAL.pdf, accessed 2 August 2021).
13. The DHS Program. Kenya malaria indicator survey [online database]. Washington DC: United States Agency for International Development; 2020 (https://dhsprogram.com/, accessed 2 August 2021).
14. Bharwani S. Overview of climate change in Kenya. 25 March 2011. In: weADAPT, the Collaborative Platform on Climate Change Adaptation [website]. Stockholm Environment Institute (https://www.weadapt.org/knowledge-base/national-adaptation-planning/kenya, accessed 22 July 2021).
15. Githeko AK, Lindsay SW, Confalonieri UE, Patz JA. Climate change and vector-borne diseases: a regional analysis. WHO Bulletin; 2000 (who.int/bulletin/archives/78(9)1136.pdf, accessed 2 August 2021).
16. Nosrat C, Altamirano J, Anyamba A, Caldwell JM, Damoah R, Mutuku F, et al. Impact of recent climate extremes on vector-borne disease transmission in Kenya. PLoS Negl Top Dis. 2021;15(3) (https://doi.org/10.1371/journal.pntd.0009182, accessed 4 August 2021).
17. Ambient air pollution data, Concentrations of fine particulate matter (PM2.5) [online database](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5), accessed 14 March 2022)
18. WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/9789240034228, accessed 13 December 2021).
19. Proportion of population with primary reliance on clean fuels and technologies for cooking (%) [online database]. World Health Organization; 2022 (https://www.who.int/data/gho/data/themes/air-pollution/household-air-pollution, accessed 14 March 2022).
20. BreatheLife Network [website]. (https://breathelife2030.org/, accessed 2 March 2022).
21. Kisumu Stakeholders Forum on Baseline Emission Inventory and Access to Energy Assessment. In: Country Government of Kisumu [website]; 30 March 2021 (https://www.kisumu.go.ke/kisumu-stakeholders-forum-on-baseline-emission-inventory-and-access-to-energy-assessment/, accessed 15 December 2021).
22. Kisumu County Integrated Development Plan, 2018–2022 (https://www.kisumu.go.ke/wp-content/uploads/2018/11/Kisumu-County-CIDP-II-2018-2022.pdf, accessed 16 July 2021).
23. County Government of Kisumu, 2020. Press Release (https://www.kisumu.go.ke/county-government-commits-to-plant-40-million-trees-by-2022/, accessed 14 March 2022)
24. Krefis AC, Schwarz NG, Nkrumah B, Acquah S, Loag W, Oldeland J, et al. Spatial analysis of land cover determinants of malaria incidence in the Ashanti Region, Ghana. PLoS ONE. 2011;6(3): e17905 (https://doi.org/10.1371/journal.pone.0017905, accessed 2 August 2021).
25. Cheng JJ, Berry P. Health co-benefits and risks of public health adaptation strategies to climate change: a review of current literature. Int J Public Health. 2013;58:305–311 (https://link.springer.com/article/10.1007/s00038-012-0422-5, accessed 4 August 2021).
26. Smith KR, Woodward A, Campbell-Lendrum D, Chadee DD, Honda Y, Liu Q, et al. 2014 - 11_Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap11_FINAL.pdf, accessed 4 August 2021).
27. Watts N. The 2020 report of the lancet countdown on health and climate change: responding to converging crises. Lancet. 9 Jan 2021;397(10269):129–170 (https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)32290-X/fulltext, accessed 2 August 2021).
28. Garrett V, Ogutu P, Mabonga P, Ombeki S, Mwaki A, Aluoch G, et al. Diarrhoea prevention in a high-risk rural Kenyan population through point-of-use chlorination, safe water storage, sanitation, and rainwater harvesting. Epidemiol Infect. 2008;136(11):1463–1471 (https://doi.org/10.1017/S095026880700026X, accessed 4 August 2021).
29. 2019 Kenya population and housing census volume IV: distribution of population by socio-economic characteristics [online database]. Kenya National Bureau of Statistics (https://www.knbs.or.ke/?wpdmpro=2019-kenya-population-and-housing-census-volume-iv-distribution-of-population-by-socio-economic-characteristics, accessed 4 August 2021).
30. Kisumu. In: Complex urban systems for sustainability and health [website]. Wellcome (https://projectcussh.org/cities/kisumu/, accessed 12 July 2021).
31. Kisumu Integrated Sustainable Waste Management Project (KISWAMP) [website]. UN-Habitat; 2015 (https://mirror.unhabitat.org/content.asp?cid=7091&catid=259&typeid=13, accessed 4 August 2021).
32. Sibanda LK, Obange N, Awour FO. Challenges of solid waste management in Kisumu, Kenya. Urban Forum; 2017 (http://dx.doi.org/10.1007/s12132-017-9316-1, accessed 4 August 2021).
33. Dianti K, Schäfer L, Milner J, Gómez-Sanabria A, Gitau H, Hale J, et al. A system dynamics-based scenario analysis of residential solid waste management in Kisumu Kenya. Sci Total Environ. 2021;777:146200 (https://doi.org/10.1016/j.scitotenv.2021.146200, accessed 6 August 2021).
34. Kisumu County Climate Change Bill. Republic of Kenya; 2020 (https://www.kisumu.go.ke/wp-content/uploads/2020/09/Climate-change-bill.pdf, accessed 7 July 2021).
35. Lake Basin Development Authority; concept paper on LBDA projects. Washington DC: US Chamber of Commerce; 2015 (https://www.uschamber.com/sites/default/files/investment_opportunities.pdf, accessed 2 August 2021).

Acknowledgements

The World Health Organization is grateful to the Kisumu County Government for its collaboration on this project. Special thanks to CDP for their coordination and development of technical content for the project, the University of Southern Denmark (SDU) for their generous contribution of technical policy expertise.

The project was led by Tara Neville from the Department of Environment, Climate Change and Health, WHO, in collaboration with the following technical focal points: Philip Agutu (Kisumu County), Samantha Coleman (WHO consultant), Evans Gichana (Kisumu County), Nienke Meinsma (CDP), James Nyagol (Kisumu County), Eleonora Orsetti (SDU), James Otieno (Kisumu County), Sandra Swanson (CDP), Nicola Tollin (SDU). WHO is grateful to Antonios Kolimenakis (WHO), Guy Mbayo (WHO), Solomon Nzioka (WHO), Diarmid Campbell-Lendrum (WHO) and Nathalie Roebbel (WHO) for their valuable contributions.

Project guidance was kindly provided by a Steering Committee comprised of Kyra Appleby (CDP), Kristine Belesova (London School of Hygiene and Tropical Medicine), Ana Diez Roux (Drexel University), Andy Haines (London School of Hygiene and Tropical Medicine), Thiago Herick De Sa (WHO) and Jose Siri (Wellcome Trust).

WHO is grateful for the financial support received from the Robert Wood Johnson Foundation. The views expressed in this report do not necessarily reflect the views of the financial donor.

Design and layout: Phoenix Design Aid A/S
Photo: © Joshua Wanyama | Dreamstime.com

For more information please contact:
Climate Change and Health Unit
World Health Organization
Geneva, Switzerland
climatehealth@who.int

LEGEND

Key climate hazards[5]

Flooding

Sea-level rise

Extreme and/ or increased precipitation

Heatwaves and/ or increased temperatures

Drought

Urban heat island effect

Air quality degradation

Key health risks

Heat-related illness and death

Injury and death from extreme weather events

Malnutrition and foodborne disease

Mental and psychosocial health

Non-communicable diseases

Respiratory illness

Vector-borne and infectious diseases

Water security and waterborne diseases

Zoonoses

Effect on health systems, including health care facilities

[5] The key climate hazards listed in this legend may not be a comprehensive list of hazards associated with climate change. Other extreme events including tropical storms or wildfires, if identified as a key hazard, will be presented on page 2.