# Extreme heat in African cities

Projections for 173 African cities show that around 25 cities will have over 150 days per year with an apparent temperature above 40.6°C for 1.7°C global warming, increasing to 35 cities for 2.1°C and 65 cities for 4.4°C warming, with west African cities most affected (Rohat et al., 2019).

Across Africa, urban population exposure to extreme heat was estimated to be 2 billion person-days per year above 40°C for 1985–2005 (that is the annual average number of days with a maximum temperature above 40.6°C multiplied by the number of people exposed to that temperature), but this is expected to increase to 45 billion person-days for 1.7°C global warming with low population growth (SSP1), and to 95 billion person-days for 2.8°C and medium-high population growth (SSP4) by the 2060s, with increases of 20–52 times 1985–2005 levels by 2080–2100, depending on the scenario (Rohat et al., 2019).

West Africa (especially Nigeria) has the highest absolute exposure and southern Africa the least. Considering the urban heat island effect, the more vulnerable populations under 5 and over 64 exposed to heat waves of >15 days over 42°C are projected to increase from 27 million in 2010 to 360 million by 2100 for low population growth (SSP1) with 1.8°C global warming, increasing to 440 million for low population growth (SSP5) with >4°C global warming, with west Africa most affected (Marcotullio et al., 2021). This portends(signifies) increased vulnerability to risk of heat stress in big cities of central, east and west Africa (very high confidence) (Gasparrini et al., 2015; Liu et al., 2017; Rohat et al., 2019).

Shifting to a low urban population growth pathway is projected to achieve a greater reduction in aggregate exposure to extreme heat for most cities in west Africa, whereas limiting warming through lower emissions pathways achieves greater reductions in exposure in central and east Africa (Rohat et al., 2019).

The African population exposed to compound climate extremes, such as coincident heat waves and droughts or drought followed immediately by extreme rainfall, is projected to increase 47-fold by 2070–2099 compared to 1981–2010 for a scenario with high population growth and 4°C global warming (SSP3/RCP8.5) and only 12-fold for low population growth and 1.6°C global warming (SSP1/RCP2.6), with west, central-east, north eastern and south eastern Africa especially exposed (Weber et al., 2020). Coincident heat waves and drought is the compound event to which the most people are projected to be exposed: ~1.9 billion person-events (a 14-fold increase) for SSP1/RCP2.6 and ~7.3 billion person-events (52-fold increase) for SSP3/ RCP8.5 (Weber et al., 2020).

1. Describe what happens to the number of cities exposed to extreme heat days. If possible, manipulate the data using calculations.

2. Write down a formula for calculating the number of person days per year exposure to extreme heat.

3. Complete the table below for the number of more vulnerable populations under 5 and over 64 exposed to heat waves of >15 days over 42°C

| | 2010 | 2100 |
|---|---|---|
| Low pop$^n$ growth & 1.8°C warming | | |
| Low pop$^n$ growth & >4°C warming | | |

4. What would be the best strategy for reducing exposure to extreme heat in west Africa?

5. What is the best-case scenario for coincident heat waves and drought in the text.

6. Research what SSP and RCP mean in the context of climate change. There are different scenarios – note these too.

## Synthesis task

Evaluate the risk to people based upon the information presented. Consider what could be done to mitigate these risks

Trisos, C.H., I.O. Adelekan, E. Totin, A. Ayanlade, J. Efitre, A. Gemeda, K. Kalaba, C. Lennard, C. Masao, Y. Mgaya, G. Ngaruiya, D. Olago, N.P. Simpson, and S. Zakieldeen, 2022: Africa. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1367, doi:10.1017/9781009325844.011