ETHIOPIA - CLIMATE HAZARD EXPOSURE AND IMPACT

Air Pollution: five-year average fine particulate matter (PM 2.5) concentrations, 2018–2022

For Humanitarian Purposes Only
Production date : 25 February 2025

Region boundary
Zone boundary
Woreda boundary
Lakes

PM2.5 mean [µg/m³] (2018 - 2022)
<= 15.00
15.01 - 30.00
30.01 - 45.00
45.01 - 54.00

Map Information:
This map shows the average levels of fine particulate matter (PM2.5) in the air over a five-year period (2018–2022), based on satellite data. In Ethiopia, urban areas experience PM2.5 levels as high as 54 µg/m³— almost four times higher than what the World Health Organization (WHO) considers safe (15 µg/m³ of daily average value).

Air pollution directly affects people's health. Long-term exposure to PM2.5 increases the risk of serious illnesses, including heart disease, stroke, lung cancer, and respiratory conditions like asthma and Chronic Obstructive Pulmonary Disease (COPD). It also makes people more vulnerable to infections like pneumonia.

The data was obtained from the Atmospheric Composition Analysis Group at Washington University in St. Louis. It is estimated using satellite observations from NASA (MODIS, MISR, SeaWiFS, and VIIRS) and the GEOS-Chem chemical transport model, which is further refined using air quality measurements from ground stations worldwide.

Uses and Limitations:
The aim of this map is to help planners and decision makers identify priority areas for interventions at woreda level. It is not designed as a standard tool for detailed site planning decisions. Map results need to be ground verified and decisions combined with specific on-site evaluation and appropriate technical expertise. Results are derived from remote sensing and computational modelling; they are not ground proofed and inherently limited by the quality of the input data/or model assumptions. The hazard data do not necessarily imply exposure and, similarly, the areas outside the hazard extents are not necessarily free from any danger.

Data Sources:
Air Pollution: Shen, S. Li, C. van Donkelaar, A. Jacobs, N. Wang, C. Martin, R. V.: Enhancing Global Estimation of Fine Particulate Matter Concentrations by Including Geophysical a Priori Information in Deep Learning. (2024).
Administrative Boundary: UN OCHA, 2024.
World Countries Boundary: Geoboundaries, 2020.
Shaded Relief: World Shaded Relief, ESRI, 2014.
Coordinate Reference System: WGS, 1984.

Disclaimers:
Data, designations and boundaries contained on this map are not warranted to be error-free and do not imply acceptance by the REACH partners, associates, donors or any other stakeholder mentioned on this map.

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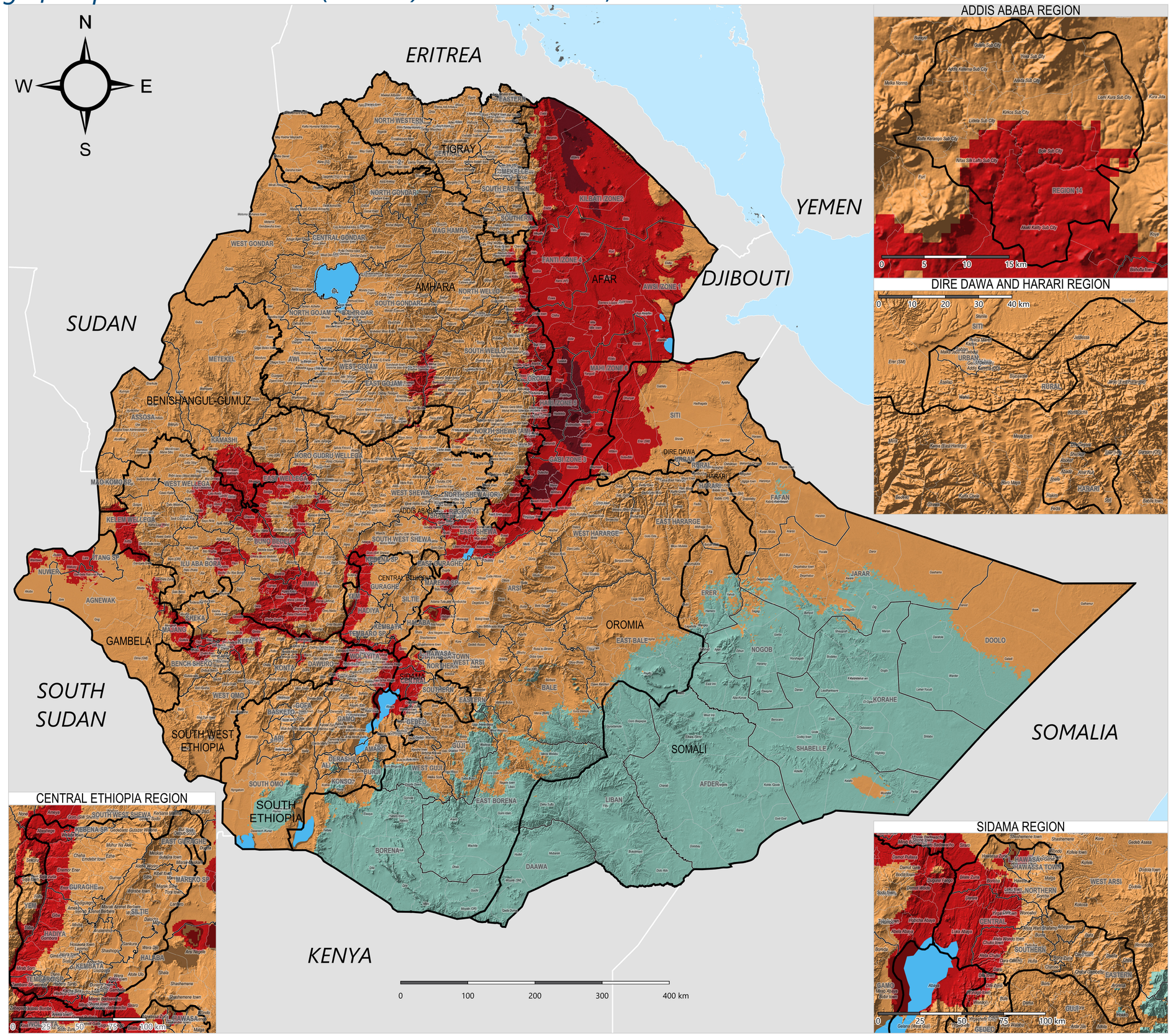
Funded by:
UKaid from the British people



ADDIS ABABA REGION

DIRE DAWA AND HARARI REGION

CENTRAL ETHIOPIA REGION

SIDAMA REGION

REACH
An initiative of IMPACT Initiatives, ACTED and UNOSAT

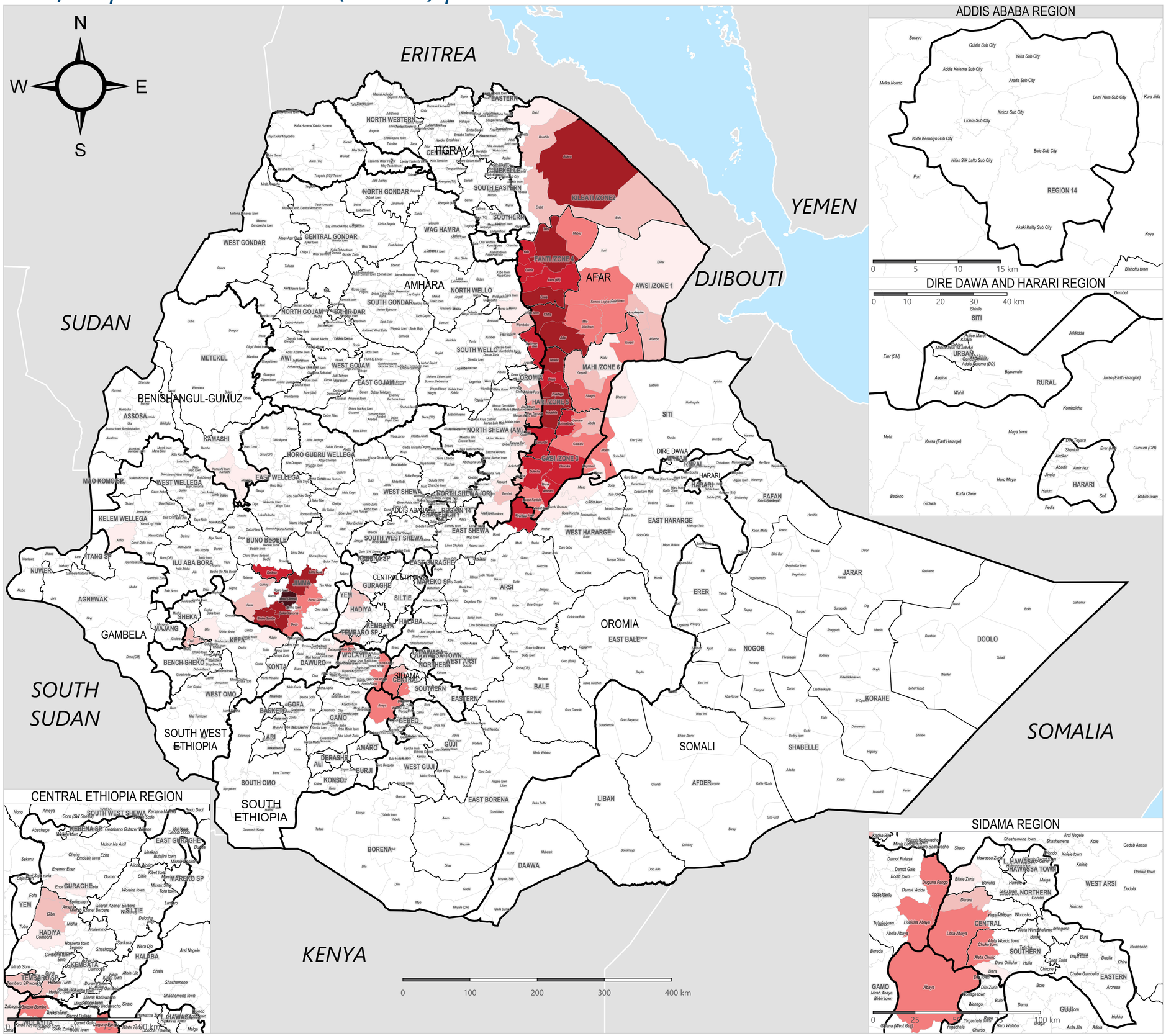
ETHIOPIA - CLIMATE HAZARD EXPOSURE AND IMPACT

Population exposed to long-term fine particulate matter (PM 2.5) pollution

For Humanitarian Purposes Only
Production date : 25 February 2025

Region boundary
Zone boundary
Woreda boundary

PM2.5 Impact Index on population
Number of people per woreda
1 - 10
11 - 50
51 - 100
101 - 200
201 - 300
301 - 450



Map Information:

The map shows the PM 2.5 Impact Index on Population estimated as the number of people exposed to harmful levels of air pollution, specifically fine particulate matter (PM2.5). It uses data from 2018 to 2022 to account for the long-term pollution trends and identify areas most at risk. To better understand the air pollution exposure, the observed air pollution levels were divided into three severity classes based on WHO guidelines: safe levels (0–15 μg/m³), moderate pollution (15–37.5 μg/m³) – 1 to 2.5 times higher than WHO's safe limit, and severe pollution (above 37.5 μg/m³) – more than 2.5 times higher than the safe limit. The population exposed to the most severe level of PM2.5 (above 37.5 μg/m³) has been calculated using the population density data (WorldPop 2020 UN-adjusted dataset). The relationship between the PM2.5 concentration and population exposure was based on the Global Exposure Mortality Model (GEMM). The function is derived from epidemiological studies and reflects how changes in PM2.5 levels affect mortality rates. For example, at lower PM2.5 concentrations (e.g., 10 μg/m³), the increase in mortality risk is relatively small. However, as concentrations rise (e.g., 35 μg/m³ or higher), the mortality risk increases more sharply. This approach helps to identify the most affected areas and people most at risk, supporting targeted action to reduce pollution and protect public health.

Uses and Limitations:

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Data Sources:

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Population: Gridded Population Count 100m, WorldPop, 2020.
PM2.5 Impact Index on Population: REACH Ethiopia Climate Hazard Exposure and Impact Assessment, February, 2025.
Methodology and Code: Amadio M. (World Bank - GFDRR) - CCDR tools data and methodology, 2024. Available at https://gfdrr.github.io/CCDR-tools
Administrative Boundary: UN OCHA, 2024.
World Countries Boundary: Geoboundaries, 2020.
Coordinate Reference System: WGS, 1984.

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