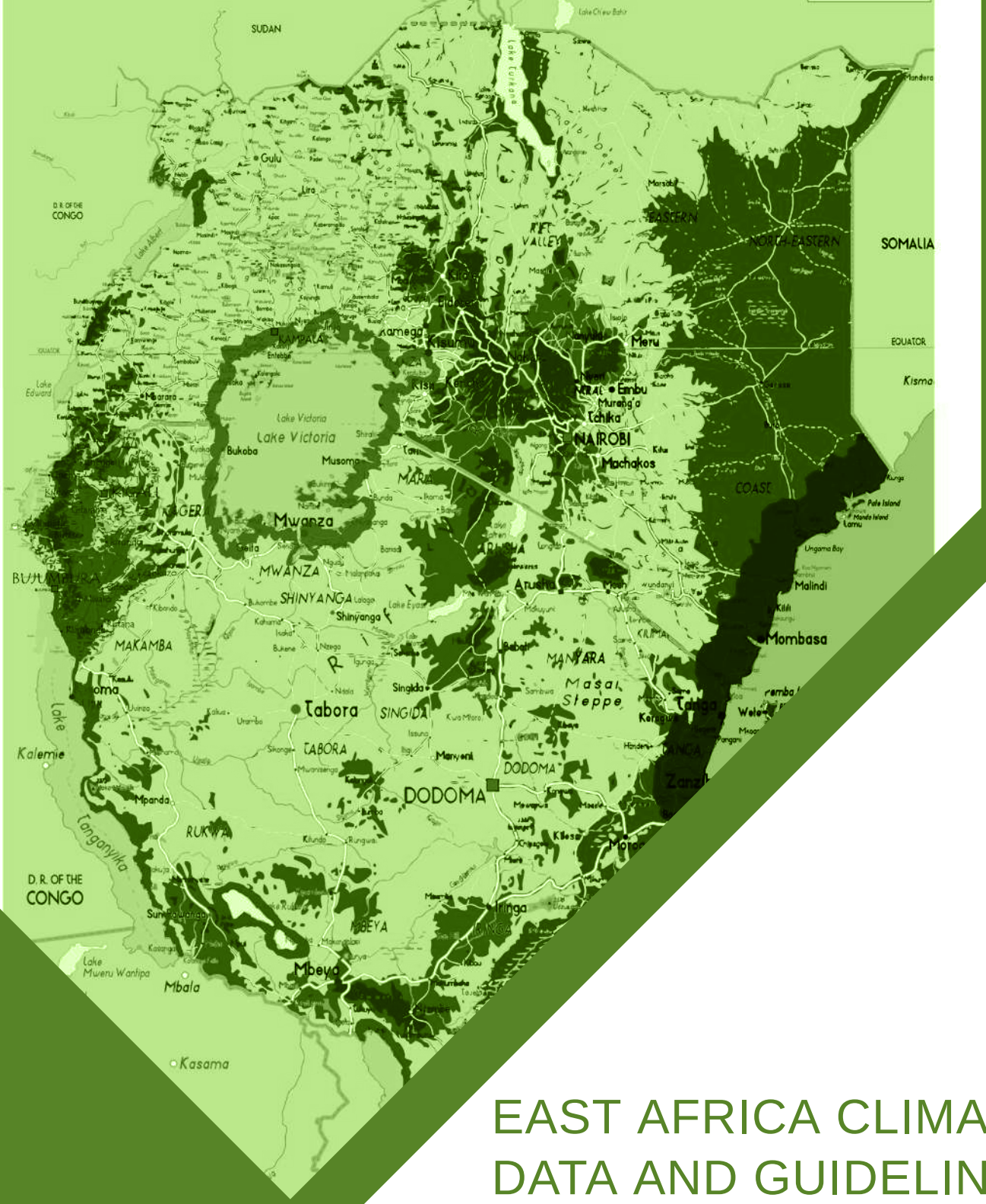

EAST AFRICA CLIMATIC DATA AND GUIDELINES FOR BIOCLIMATIC ARCHITECTURAL DESIGN

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EXECUTIVE SUMMARY

This report presents climatic data of different regions in East Africa that was compiled within the project Promoting Energy Ef ciency in Buildings in East Africa. This project was initiated by UN-Habitat in collaboration with the Governments of Kenya, Uganda, Tanzania, Rwanda and Burundi and the United Nations Environmental Program (UNEP). Funded by the Global Environment Facility (GEF) and co-funded by the ve East African countries, the project was designed to help countries in East Africa to integrate energy ef ciency measures into their building policies and practices to reduce energy demand.

East Africa is divided into six unique climatic regions – hot and humid e.g. Dar es Salaam, hot-arid e.g. Garissa, hot semi-arid / savannah e.g. Dodoma, great lakes e.g. Kampala, upland e.g. Kigali and high upland e.g. Eldoret - each requiring different design strategies to minimise energy consumption and maximise indoor thermal comfort.

Climatic data for 20 major towns in Kenya was obtained from the open database of the U.S. Department of Energy[1] while data from major towns in Tanzania (6), Uganda (1) and Rwanda (1) was obtained under license from Meteotest through the software Meteonorm[2]. These data sets, which are Typical Meteorological Year (TMY), contain hourly meteorological values for a 1-year period that characterise climatic conditions at a speci c location over a long period of time such as 30 years.

The data was analysed and presented graphically (inform of psychrometric charts) using Climate Consultant 6.0 - a graphic based climate data analysis computer program. Microsoft Excel program was also used to generate climate data graphs. From the analysis, it was clear that each zone requires different passive building design strategies to achieve human thermal comfort as well as minimise the energy required for heating and cooling. Some of the interventions that are suited for all the climatic zones include:

- Orientation of the building along the east – west axis with major openings facing north and south.
- Protection of all openings using appropriate sun shading devices against unwanted solar radiation.
- Provision of openings for natural ventilation and daylighting – large openings are more suitable for hot and humid climates while small openings are preferred in hot arid and hot semi-arid / savannah climates.
- Single-banked oor plans in hot humid and great lakes climate to maximise cross ventilation while double-banked building forms are desirable for uplands and high upland climates.
- Open layouts are recommended for hot humid and great lakes climates to allow maximum ventilation while compact housing layouts are preferred in hot arid and hot semi-arid / savannah climates for mutual shading and provision of cool spaces when combined with plants and water features as well as protection against hot, dry winds.
- Use of light coloured or re ective external surfaces to re ected unwanted solar radiation.
- Light weight building envelope is recommended for hot and humid climates to maximise air ow; medium weight building structures are recommended for hot semi-arid / savannah and great lakes climate to even out indoor temperatures; and high thermal mass building materials are preferred for hot and arid climates because of the high daily temperature swing; and medium weight structures are recommended for uplands and high uplands climates for best exploitation of passive solar gains for passive heating.

1 U.S Department of Energy (n.d.) Weather Data | EnergyPlus [Online]. Available from: <https://energyplus.net/weather>.

2 Meteotest (n.d.) Meteonorm: Irradiation Data for Every Place on Earth [Online]. Available from: <http://www.meteonorm.com/en/>.