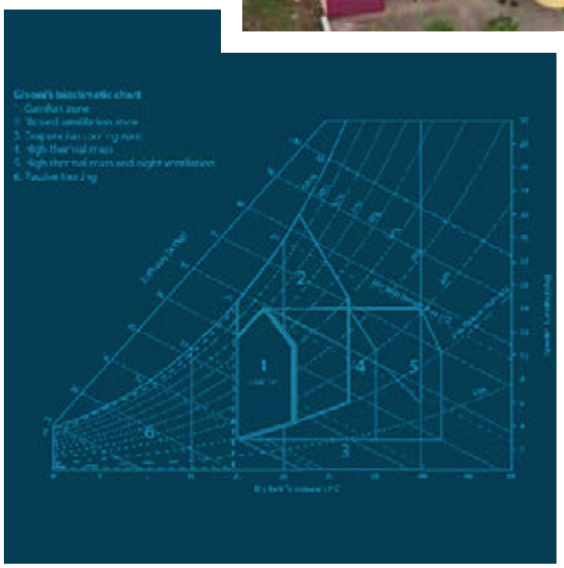
SUSTAINABLE BUILDING DESIGN FOR TROPICAL CLIMATES

Principles and Applications for **Eastern Africa**



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SUSTAINABLE BUILDING DESIGN FOR TROPICAL CLIMATES

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SUSTAINABLE BUILDING DESIGN FOR TROPICAL CLIMATES
Principles and Applications for Eastern Africa

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DISCLAIMER

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01 INTRODUCTION

.... The architect should be equipped with knowledge of many branches of study and varied kinds of learning, for it is by his judgement that all work done by the other arts is put to test.....

... He ought, therefore, to be both naturally gifted and amenable to instruction. Neither natural ability without instruction nor instruction without natural ability can make the perfect artist. Let him be educated, skilful with the pencil, instructed in geometry, know much history, have followed the philosophers with attention, understand music, have some knowledge of medicine, know the opinions of the jurists, and be acquainted with astronomy and the theory of the heavens...

Marcus Vitruvius Pollio, De Architectura, Year 15 B.C.

1.1 BACKGROUND

Climate change and resource depletion are the main challenges that mankind has to face in the 21st century. Through its impact on ecology, rainfall, temperature and weather systems, global warming will directly affect all countries. Nobody will be immune to its consequences. However, some countries and people are more vulnerable than others. In the long term, the whole of humanity faces risks but the more immediate risks are skewed towards the world's poorest and most vulnerable people.

We know that the world is warming and that the average global temperature has increased by around 0.7 °C since the advent of the industrial era. We also know that this trend is accelerating: average global mean temperature is rising by 0.2 °C every decade. With the global rise in temperature, local rainfall patterns are changing, ecological zones are shifting, the seas are warming and the ice caps are melting.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change[1] (IPCC) states that significant global impacts on ecosystems and water resources are likely at global temperature rises of between 1 and 2 °C, and that net negative impacts on global food production are likely to occur at temperature increases from 2-2.5 °C upwards, compared to pre-industrial levels (Fig. 1.1-1). The IPCC report also says that up to 2050 substantial global emission reductions of at least 50% below 1990 levels are needed, with additional global emission reductions beyond 2050, moving towards a zero carbon economy by the end of the century. This is the only way to keep the temperature increase to 2 °C, which is considered to be the maximum we can afford without incurring catastrophic consequences.

The present situation is very worrying. In 2010, world greenhouse gas (GHG) emissions reached 7 tons CO_2 eq per capita[2], with a large gap between developed and developing countries (Fig. 1.1-2). To achieve the 2 °C target, world GHG emissions should be reduced to 2 tons CO_2eq per capita. EAC countries are presently at about this level; the challenge is to keep the same level of emissions without curbing economic development.

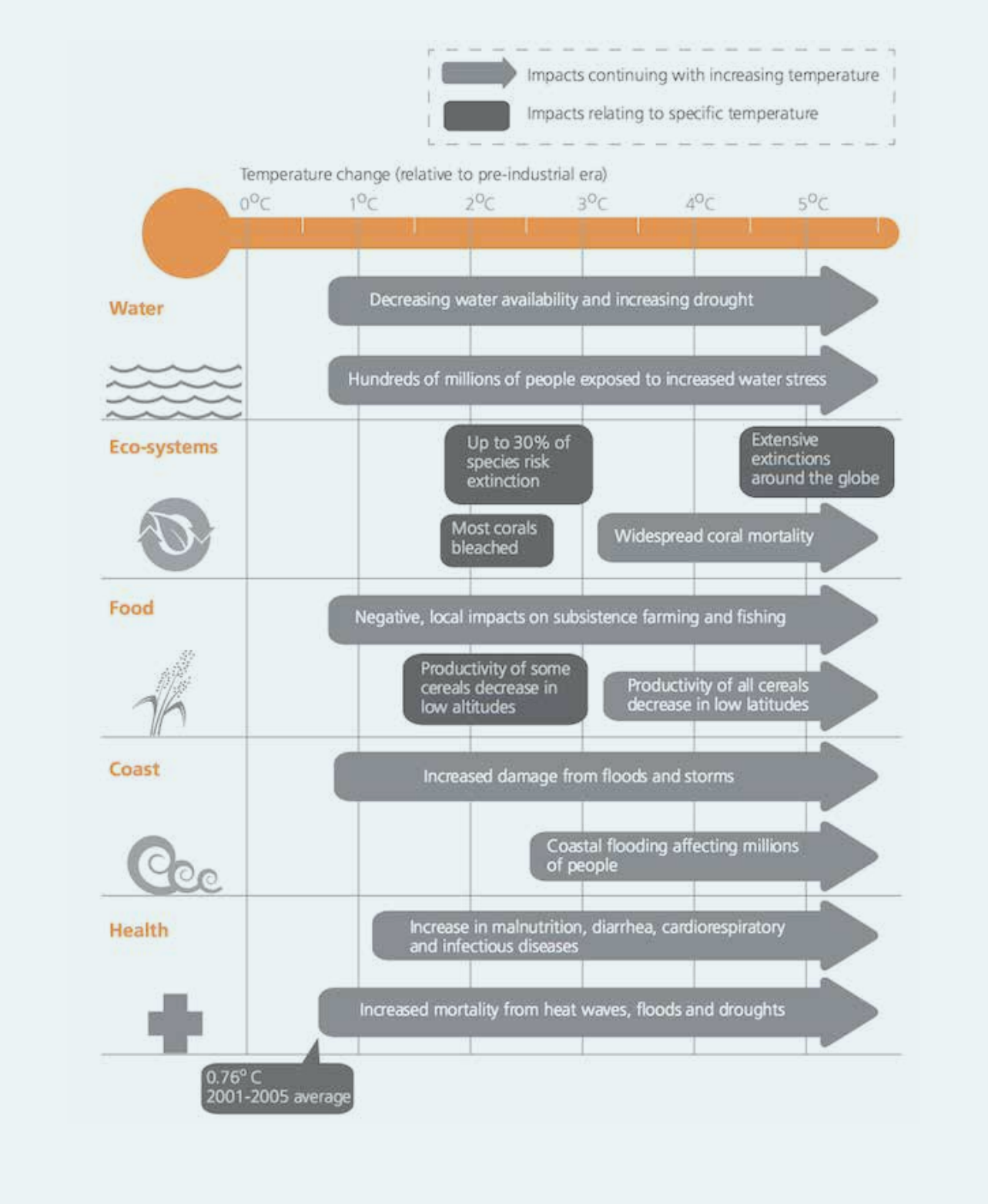
Resource depletion is another critical issue. Both mineral and biological and resources are being depleted and little is going to be left for our descendants. Most essential minerals are going to last less than 40 years (Fig. 1.1-3), because of the progressive reduction of the ore grades.

Biological resources are also being rapidly depleted: our ecological footprint is growing and the planet's biocapacity is shrinking. Since the 1970s, humanity's annual demands on the natural world have exceeded what the Earth can renew in a year. This "ecological overshoot" has continued to grow over the years, reaching a 50 per cent deficit in 2008.

1 *http://www.ipcc.ch*

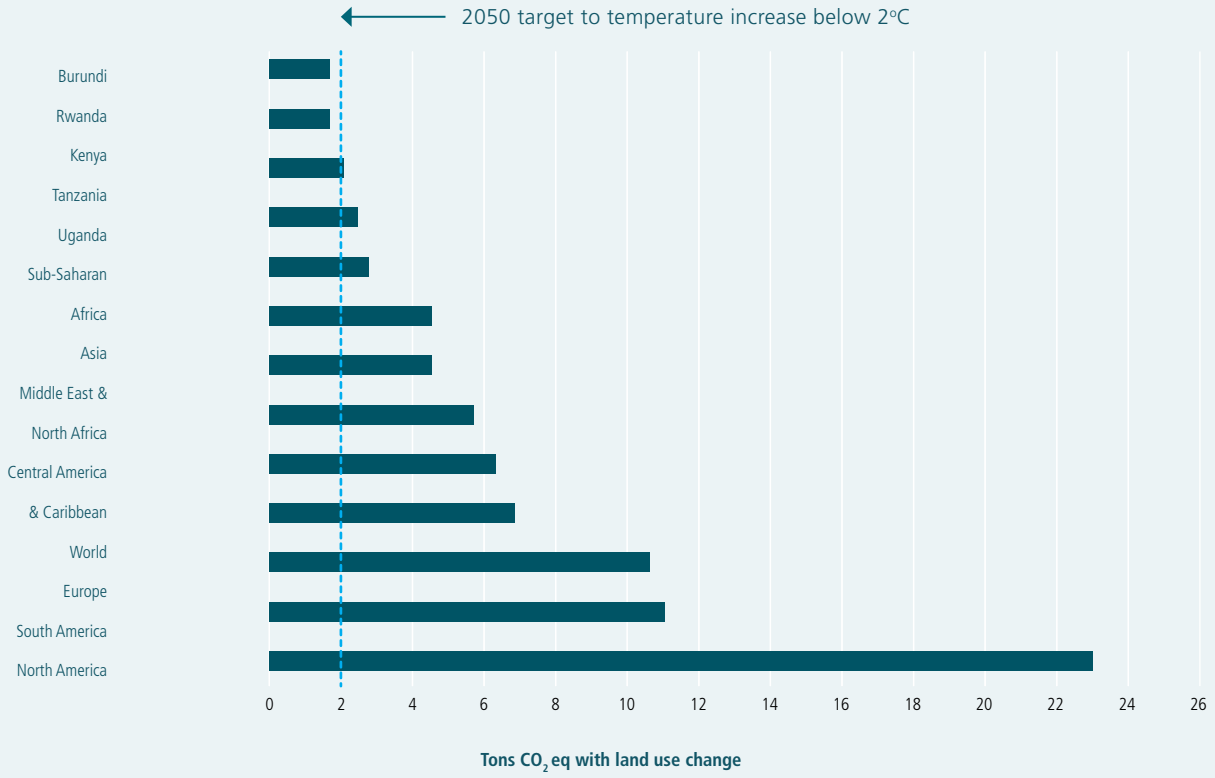
2 *Total GHG gas emission in 2010 was 48628 Mton eq (source: Ecofys, Updated information on the world's greenhouse gas emissions, 2013 - http://www.ecofys.com/en/news/updated-information-on-the-worlds-greenhouse-gas-emissions/) and the world population 6916183 thousand (source: UN, Dept. Economic and Social Affairs - http://esa.un.org/unpd/wpp/unpp/panel_population.htm)*

FIGURE 1.1-1 **IMPACT OF 2 °C GLOBAL TEMPERATURE INCREASE**



Source: *UN-Habitat, Sustainable Urban Energy: A Sourcebook for Asia, 2012*

FIGURE 1.1-2 **GREENHOUSE GAS EMISSIONS IN THE YEAR 2000**



Source: *Wikipedia - http://en.wikipedia.org/wiki/List_of_countries_by_greenhouse_gas_emissions_per_capita*

FIGURE 1.1-3 **POTENTIAL SHORTAGE OF MATERIALS – RESERVES (2010 PRODUCTION)**