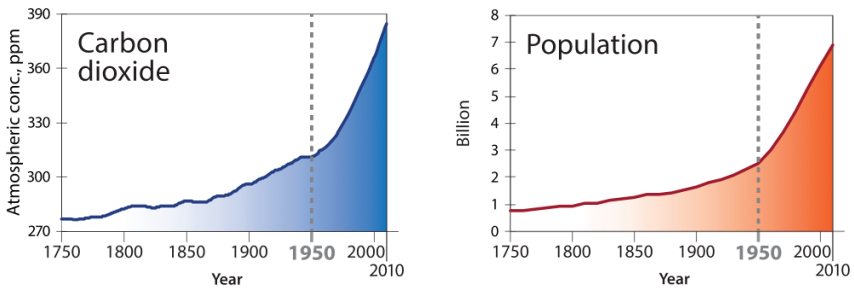

EDITORIAL INTRODUCTION:

Vulnerable Populations: The Role of Population Dynamics in Climate Change Resilience and Adaptation in Africa

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It is intuitively appealing to read the simultaneous growth in population and CO₂ emissions shown in Figure 1 as a simple causative relationship. However, the connections between population and climate change are complex. The massive increase in the human impact on the global environment since 1950, dubbed 'The Great Acceleration' (Steffen et al., 2015), is correlated with rapid global population and economic growth. However, while the former was greatest in the Global South, the latter was concentrated in the Global North. Areas with presently high rates of population growth are amongst the lowest emitters of greenhouse gases (GHGs). According to the Intergovernmental Panel on Climate Change (IPCC), while the richest ten per cent of the global population, two thirds of whom live in developed countries, contribute between 36–45 per cent of global GHG emissions, the emissions of poorer residents of emerging countries are between five and fifty times lower (IPCC, 2022).

Nonetheless, as acknowledged by the IPCC (2022), population growth is a major indirect driver of GHG emission growth and, although consumption remains the most significant driver, various commentators have noted that reducing population growth can play an important role in reducing future emissions (O'Neill et al., 2012; Casey and Galor, 2017; Bongaarts and O'Neill, 2018; Wolf et al., 2021). While projected population growth will undoubtedly increase emissions, high rates of population growth are also positively correlated with increased vulnerability to the effects of climate change (Price, 2020). Sub-Saharan Africa has the highest

Figure 1. Annual CO2 emissions and population 1750–2010

(SOURCE: ADAPTED FROM STEFFEN ET AL. 2015 WITH THE KIND PERMISSION OF THE LATE WILL STEFFEN)

rate of population growth (UN, 2022) and is also the one of the most vulnerable continents to climate change (IPCC, 2014; 2022). This special issue of *The Journal of Population and Sustainability* focuses on population growth as a factor in the resilience and adaptive capacity of communities in Africa facing the effects of climate change.

It is well established that climate change is likely to disproportionately affect the people of the poorest regions of the world who will suffer adverse health effects due to extreme heat, growth of disease vectors, increasing water scarcity, soil erosion, crop failure, flooding of low-lying areas, and so forth (IPCC, 2014). Moreover, there is a broad consensus that high rates of population growth adversely affect development and welfare improvements and can negatively impact the availability of natural resources (Das Gupta et al., 2011; Beegle and Christiaensen, 2019; Price, 2020). The precise relationships between high rates of population growth, low levels of economic development, climate vulnerability, resilience and adaptation are complex and geographically uneven. However, in areas vulnerable to climate change, high rates of population growth have a negative impact on the community's resilience and adaptive capacity (Beegle and Christianensen, 2019; Price, 2020).

Importantly, climate-change related impacts exacerbate existing inequalities of power. Women and girls are frequently the most disadvantaged and least skilled members of a community and therefore disproportionately vulnerable. A lack of adaptive capacity in the face of climate-change-associated extreme weather

events has the potential to disrupt sexual health and family planning services, amplifying the vulnerability of women to such events as well as increasing exposure to sexual and gender-based violence (Kwauk and Braba, 2017; Price, 2020; Logie, et al. 2021). Poor resilience and adaptive capacity can also lead to wider social conflict and climate induced migration with associated negative impacts on welfare (Kelley, 2016; Cattaneo et al., 2019).

Shifts in the age structure of populations present problems and opportunities. For the greatest part of human history, population growth was incredibly low at an average of around 0.04 per cent annually (Roser et al., 2013). While this did not mean that the age composition of populations was absolutely stable for all societies at all points in time, it does mean that on average the population age structure remained fairly stable. However, crudely put, the industrial revolution disrupted this relative stability by indirectly improving overall health and lowering mortality, especially amongst children, which in the absence of changes in fertility behaviour led to rapid population growth. The so called 'demographic transition' experienced by the majority of countries in the Global North, where birth rates shifted toward an equilibrium with reduced mortality rates, produced a 'demographic dividend' where the working age population grew relative to dependents. In Africa, while mortality rates have steadily declined, reductions in fertility have not followed the same pattern experienced in the Global North. In the first paper of this special issue, Sunday Adedini and colleagues argue that there are clear synergies between producing a demographic dividend, economic development and tackling climate change vulnerability in Africa.

While all continents will experience the adverse effects of climate change, Adedini et al. point out that 'since Africa has many of the world's poorest nations, resilience and adaptive capacity are poor. The effects of climate change are already causing extreme weather events which destroy infrastructure, exacerbate food insecurity and frequently lead to forced migration and the growth of insanitary informal settlements. Moreover, climate change is adversely affecting health through exposure to more extreme temperatures and the creation of conditions for the proliferation of disease. The effects of climate change threaten to erode emerging socioeconomic gains and these setbacks, combined with high rates of population growth, exacerbate climate change vulnerability. Adenini et al. argue that tackling unsustainable population growth through the provision of quality family planning services, reducing adolescent fertility, educating female children, empowering

women and reducing under-five mortality is critical to creating a demographic dividend and building resilience to the effects of climate change.

In a previous issue of the *JP&S*, Illan Kelman (2020) argued that so called 'natural disasters' are not natural at all but the result of societal choices which assist or hinder society's ability to cope with disasters. Vulnerability to disaster is an outcome of these societal choices which enable or constrain a society's ability to cope. However, framing vulnerability in terms of choice must also acknowledge the wider structural context and constraints on agency. For many developing countries, seemingly inexorable urbanisation not only takes place within the context of regional socioeconomic change but also within the wider context of global economic relationships as well as changing environmental conditions. The ability of individual agents to choose, in a situation of forced migration for example, is clearly constrained and even national and regional institutions must order their priorities in the context of conditions outside of their control.

Nonetheless, as Stephanie Dos Santos and colleagues point out in their article in this issue, the vulnerability of growing urban populations to disasters is frequently an outcome of inadequate policy. Dos Santos et al. are directly concerned with the combined effect of environmental and social factors in vulnerability to flooding in African cities. Their interdisciplinary study analyses household level data from contrasting residential areas affected by flooding in the city of Abidjan, Côte d'Ivoire. Abidjan has experienced significant growth over the last sixty years, seeing a 27-fold increase in population to 5.3 million. The two study areas, while both poor in global terms, differ significantly at a socio-economic level, with indicators such as the number of slum and informal dwellings and population density marking a clear demarcation in terms of prosperity. Dos Santos et al. also analysed physical environmental conditions in their two sample areas at a fine level, determining that these factors were significant contributors to flood vulnerability. Their analysis is consistent with other studies showing a clear link between socio-economic factors and flood vulnerability and they observe that urban disasters consequent upon climate change amplify urban inequalities. However, household level physical environmental conditions also contributed significantly to flood vulnerability, leading Dos Santos et al. to conclude that the multidimensional nature of vulnerability at the household level must be understood by policymakers in post-disaster management.

In our third article for this special issue, Paige Passano, Min Ah Choi and Matt Matusiewicz address the threats to social wellbeing and stability in the Sahel posed by climate change, population growth and malnutrition. This semi-arid region of Africa is amongst the most vulnerable regions to the effects of climate change. Projected increases in surface temperature of between three and five degrees Celsius by 2050 will exacerbate the region's existing ecologically fragility. The Sahel also contains some of the world's poorest nations with the highest rates of population growth. Indeed, as Passano et al. report, in 1950 the Sahel was sparsely populated with less than fifty million people, but persistently high fertility levels have led the population to grow to over 500 million today with a projected figure of over 900 million by 2050. The authors argue that high rates of population growth combined with deteriorating environmental conditions threaten to reverse developmental gains and overwhelm relief efforts. Acknowledging the value of attempts to boost community resilience through programmes developing critical infrastructure, water conservation, degraded land restoration, biodiversity protection, income diversification etc., Passano et al. observe that the benefits of addressing population growth are frequently overlooked or dismissed. However, they argue that lowering fertility, through the education of girls and provision of voluntary family planning, is essential to strengthening resilience and adaptive capacity and avoiding humanitarian catastrophe.

Presently more than half the global population reside in towns and cities, and by 2050 that figure is expected to rise to more than two thirds (Ritchie and Roser, 2018). Thus, as Dos Santos et al.'s article makes clear, planning for and mitigating the effects of climate change on cities will be critical to the welfare of billions. While the growth of the world's megacities attracts much attention, in our last article Sunday Adedini argues that intermediate cities of less than one million people will absorb most of Africa's burgeoning urbanisation, accommodating more than half of the continent's population by 2030. However, the critical infrastructure of these cities is far from adequate, making them more vulnerable than larger and more established conurbations to climate related stresses and events such as flash flooding. In particular, Adedini notes that many of these intermediate cities are strongly connected with the surrounding agricultural areas and hence more vulnerable to climate related agricultural failure.

Population growth in these cities is largely driven by rural to urban migration, but high fertility rates are also significantly contributing to their expansion. Moreover, the majority of residents are poor, rendering them particularly vulnerable to climate stressors. Adedini argues that great improvements in urban planning policies, investment in critical infrastructure, disaster mitigation and health care systems are required to ensure good welfare in the face of environmental change. However, such development takes time and Adedini advocates investment in family planning as a critical means to slow the rate of urban population growth and ameliorate pressure on resources, which will not only improve resilience to climate change but lead to greater prosperity.

While population growth can be shown to be an indirect driver of climate change, the articles in this special issue of the *JP&S* demonstrate how a combination of demographic, socio-economic and environmental factors create conditions of vulnerability in many regions of Africa. In particular, high fertility and rural to urban migration are exacerbating the unfolding effects of climate change, threatening the welfare of millions. However, it is also clear that progressive and equitable policies can empower women and lower fertility rates and that, in combination with good governance and informed urban planning, urban areas in particular can be made more resilient to the impact of climate change.

Programmes to increase resilience and adaptation require resources. The United Nations Environment Programme estimates that sub-Saharan Africa will need in the region of \$36 billion a year, the highest as a proportion of GDP of any region, to finance climate adaptation (UNEP, 2022). Given that it is clear that the populations of the Global North have been the greatest beneficiaries of fossil fuelled economic growth, questions of climate justice are germane.

Recent work for Earth4All (<https://earth4all.life/>) by Callegari and Stoknes (2023) proposes that diverting two to four per cent of global GDP toward enabling what they term a 'Giant Leap' could avoid or ameliorate the worst consequences of the environmental crisis whilst greatly improving the welfare of the world's poorest people. They argue that, by progressively raising the taxes of the richest ten per cent of the global population by between four and eight per cent, a concerted and internationally coordinated effort could achieve five key turnarounds:

1. End poverty
2. Address gross inequality
3. Empower women
4. Create a food system healthy for people and ecosystems
5. Transition to clean energy

Earth4All's modelling suggests that addressing these objectives would lead to population peaking at 8.5 billion in 2040 and declining to 6 billion by 2100, while greenhouse gases would continuously fall such that global warming could be kept below 2°C above preindustrial levels.¹ Such outcomes are clearly consistent with the broader themes and concerns articulated by contributors to this special edition of the *JP&S* and, while Earth4All's proposals are ambitious, Callegari and Stoknes emphasise that they are nonetheless achievable:

These extraordinary turnarounds are designed as policy and investment road maps that will work for the majority of people. They are not an attempt to create some impossible-to-reach utopia; instead, they are an essential foundation for a resilient civilisation on a planet under extraordinary pressure. The world is increasingly recognising that there are sufficient knowledge, funds and technologies in the world to implement them. (p. 20)

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1 Critically, the model assumes that carbon capture and storage will play a significant role.

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