Climate change and locust outbreak in East Africa

To the Editor – From the end of 2019 to early 2020, a desert locust (*Schistocerca gregaria*) outbreak across several East African countries posed a serious risk to food security and livelihoods. A second wave is currently active and threatening the region's agropastoral areas. Although desert locusts have been here since biblical times, recent intense outbreaks can be linked to anthropogenic climate change and the increased frequency of extreme weather events[1–3]. Current locust plagues are further exasperated by local economic and political limitations, which facilitate locust spread and place particular pressure on already vulnerable communities.

In May 2018, an unusually powerful tropical cyclone (Mekunu) made landfall over the Arabian Peninsula. Tropical cyclones usually weaken upon reaching land, but Mekunu crossed over Oman, causing heavy rainfall that created desert lakes over the 'Empty Quarter' in Saudi Arabia (Fig. 1). The warm, sandy and wet soil was the perfect environment for desert locusts to hatch from eggs, develop and breed[4]. The dry conditions in this region would normally kill these breeds, but another tropical cyclone (Luban) followed in October 2018, providing a lifeline for the continuation of the first outbreak[2]. The outbreak spread to Yemen, where it continued uncontrolled due to political instability and lack of coherent government response[2,5]. By the end of 2019, the winds of yet another tropical cyclone, Pawan, facilitated the migration of desert locusts to East Africa. A lack of preparedness, chronic political instability and limited capacity made the invasion the worst in a quarter of a century for most countries, and the worst in 70 years for Kenya.

Controlling such outbreaks requires a swift and coordinated response. However, the Desert Locust Control Organization for Eastern Africa — the regional organization responsible — has been neglected and under-resourced by member countries[1]. The limited financial capacity of some of the affected countries and the lockdown due to the coronavirus pandemic have further hampered control efforts. Additionally, armed conflict in Somalia rendered some of the locust breeding areas inaccessible. In many cases, the required pesticides, protective gear and locust control experts were not made available in time to allow effective control at the local level.

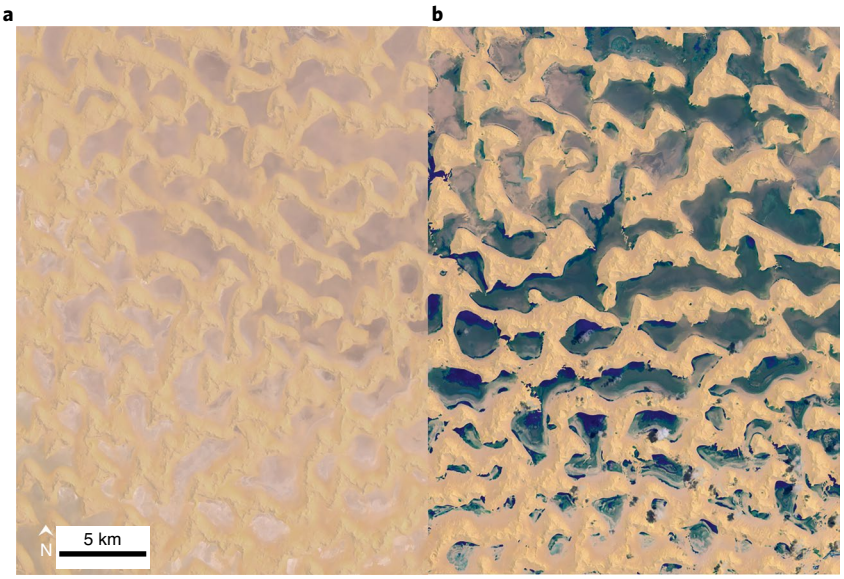

Fig. 1 | Desert lakes in the 'Empty Quarter'. Pools of water form in Rub' al-Khali desert, also known as the 'Empty Quarter', due to intense rainfall under tropical cyclone Mekunu. **a**, Photograph taken on 13 May 2018 shows normal dry conditions. **b**, Photograph taken on 29 May 2018 shows the 'desert lakes' that facilitate locust breeding and survival. NASA Earth Observatory images by L. Dauphin using US Geological Survey data.

Attribution of a single event to climate change is difficult. However, climatic changes such as increases in temperature and rainfall over desert areas, and the strong winds associated with tropical cyclones, provide a new environment for pest breeding, development and migration. This suggests that global warming played a role in creating the conditions required for the development, outbreak and survival of the locusts[5].

About 90% of anthropogenic heat is absorbed by the oceans[6,7], and the western part of the Indian Ocean is the fastest-warming in the tropical Ocean system, with a summer average increase of 1.2 °C (ref. [8]). This warming has increased the frequency and intensity of extreme climate events in neighbouring regions[9–11]. The strongest cyclones on record to affect the Arabian Peninsula occurred in the past 15 years (Gonu, 2007; Phet, 2010; and Mekunu, 2018). The strongest recorded cyclone to hit Somalia, Sagar, occurred just a few weeks before Mekunu. In 2019, a record-breaking eight tropical cyclones developed over the Indian Ocean and made landfall over different locations in Asia and East Africa. In March to April 2019, Mozambique was impacted by cyclones Kenneth and Idai, the strongest tropical cyclones on record, surpassing the severity of the season of February to March 2000 in which the country was also devastated by two cyclones (Eline and Hudah).

Moreover, from October to December 2019, the Indian Ocean Dipole (IOD) experienced one of its strongest positive phases, causing one of the wettest rainy seasons in East Africa. Djibouti City received 336 mm of rainfall in four days, equivalent to two normal years' worth. Such events are likely to increase in the future; in a 1.5 °C warmer climate, extreme positive IODs are expected to occur twice as often[12]. The increased cyclone frequency and more extreme climate variability could increase the likelihood of pest outbreaks and spread. This adds compromised food security to the consequences of the storms themselves. Desert locusts feed on a range of green vegetation (for example, crops, grass, shrubs

and trees), threatening human and animal food security. The first-wave of infestations at the end of 2019 destroyed 70,000 ha of farmland in Somalia and Ethiopia, and 2,400 km (ref. [2]) of pasture land in Kenya[1]. A recent assessment in Ethiopia estimated that between December 2019 and March 2020, locusts damaged 114,000, 41,000 and 36,000 ha of Sorghum, maize and wheat, respectively[13].

The recent locust outbreaks and the role of Indian Ocean warming show that the impact of climate change is not merely the consequences of changes in mean temperature, but also of increases in extreme and unprecedented events. Such extremes are exacerbated further in a butterfly effect by non-climate factors such as political instability, armed conflicts, poor governance, weak early warning systems and limited financial resources, hurting the most vulnerable communities.

In this context of a changing climate, increased climate variability and the vulnerability of the socio-economic activities to these factors, it is crucial for each government in the region to put in place a multi-hazard early warning system. Such a system should include robust surveillance and forecasting methods, dissemination channels and response mechanisms to avert the potential impacts of extreme events. Understandably, these countries have limited financial resources, but spending on an efficient early warning system is an investment of guaranteed returns. As part of climate justice, the developed countries have a moral obligation to support those countries that do not have the resources for such investment. ❐

Abubakr A. M. Salih ✉, Marta Baraibar, Kenneth Kemucie Mwangi and Guleid Artan

The Intergovernmental Authority on Development Climate Prediction and Applications Centre (ICPAC), Nairobi, Kenya.

✉*e-mail: abubakr@icpac.net*

Published online: 30 June 2020
https://doi.org/10.1038/s41558-020-0835-8

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Acknowledgements

A.A.M.S. and K.K.M. are funded by the European Union through Satellite and Weather Information for Disaster Resilience in East Africa (SAWIDREA) and GMES and Africa projects, respectively. M.B. is supported by NORCAP, a global provider of expertise to the humanitarian, development and peace-building sectors operated by the Norwegian Refugee Council (NRC). G. A. is supported by the Intergovernmental Authority on Development (IGAD).