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Sandstorms, an increasingly common global disaster exacerbated by land degradation

A woman and her daughter walk through the town of Guwahati, in the state of Assam, India, in May 2021 during a sand and dust storm, a common weather phenomenon in northern India, but one that has intensified over the past 20 years.

(David Talukdar/NurPhoto via AFP)

NEWS

By Christelle Marot
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It is a wall of orange sand several hundred metres high, driven by powerful gusts of wind, 50 knots on average, which can engulf and plunge a town into darkness in a few minutes. The people of Niger, Chad, Mali, Sudan, together with Iraq, Iran, Kuwait, and even Texas and Arizona are familiar with this spectacular phenomenon, which meteorologists call "*haboob*" ("strong wind" in Arabic), one of the most dangerous manifestations of sand and dust storms.

In Niger, Katiellou Gaptia Lawan, director of the national meteorological office, lives with these dry mists of airborne dust from October to April and *haboobs* during the monsoon: "People are used to it. There are *haboobs* almost every year, but they are getting more frequent. And when these sand walls come, it's like the apocalypse is coming." These sandstorms originate almost 1,000 kilometres east of the Nigerien capital of Niamey, in the heart of the Bodélé depression, a former freshwater lake in Chad that has completely dried up and is the largest source of dust emissions on the earth's surface. To form they require just two ingredients: erosion-sensitive sediments in a dry environment and strong wind.

Researchers estimate that about two billion tonnes (https://www.bmj.com/content/371/bmj.m3089) of dust are lifted into the atmosphere each year, a quarter of which reaches the oceans. Half of the mass lifted comes from the Sahara Desert. A quarter comes from the Taklamakan Desert in China and the Gobi Desert in Mongolia, as well as from the Middle East. There are also regional basins in North and South America, southern Africa and Australia, where significant storms are observed at the local level. These dust cycles interact with other global biogeochemical cycles, notably the climate, the oceans and biodiversity. Dust from the Sahara, for example, fertilises the forests of the Amazon. The cycles also vary over time, depending on the region and human activity.

"In recent years, these storms have increased in number and intensity in parts of the Middle East and central and north-east Asia," says Nicholas Middleton, an Oxford University geographer (https://www.geog.ox.ac.uk/staff/nmiddleton.html) and globetrotter who specialises in desertification and sandstorms.

The United Nations Environment Programme (UNEP) predicts that Iraq could experience 300 dust events per year by 2025, twice as many as a decade ago.

Simulations by the World Bank (https://documents1.worldbank.org/curated/en/483941576489819272/pdf/SAND-AND-DUST-STORMS-IN-THE-MIDDLE-EAST-AND-NORTH-AFRICA-MENA-REGION-SOURCES-COSTS-AND-SOLUTIONS.pdf) suggest that annual global dust emissions have increased by 25-50 per cent over the past century in the Middle East and North Africa.

"There are natural variabilities in these dust storms," points out Carlos Pérez Garcia-Pando, a scientist specialising in the study of atmospheric masses at the Barcelona Dust Regional Centre (https://dust.aemet.es/) and holder of a chair in mineral dust (https://www.axa-research.org/fr/projet/carlos-garcia-perez-pando) financed by the

insurance group Axa. “In some regions their frequency is decreasing, because there is a decrease in wind, but we don’t really know why. One hypothesis is the deceleration of the polar vortex, which could be related to climate change. Elsewhere, the situation is the opposite. Satellite images show a very significant increase in dust due to drought and more extreme temperatures, which we are seeing in the Middle East.”

Similarly, the drying up of lakes or seas such as the Aral Sea, and the creation of reservoirs and artificial dams in Iran and in Ouarzazate in Morocco, feed the phenomenon of dust storms. By preventing water from draining away, ecosystems die and vegetation dies, making the soil and sand mobile. Human activity is cutting off water supply, largely driven by agricultural needs.

The lack of rainfall, which reduces ambient humidity, is also an aggravating factor, as is the case in southern Brazil (https://news.yahoo.com/catastrophic-sandstorms-leave-least-6-181520206.html) for example. Equally, the exodus of rural populations, as was the case in Syria before the war due to drought, makes abandoned, untended land even more erosive.

Economic and health consequences

Sandstorms can paralyse an entire economy, cause road accidents, ground aircrafts, and jam radar and electronic systems, with consequences for agriculture that are still poorly assessed as well as serious long-term health impacts. Exposure to dust of a few microns can cause conjunctivitis and dermatological disorders.

Inhalation of dust can cause asthma, respiratory diseases such as silicosis, and cardiovascular diseases such as bronchitis and emphysema.

In the Sahel, episodes of bacterial meningitis are strongly correlated with the occurrence of sandstorms during the Harmattan season between December and March. In the drylands of America, valley fever or coccidioidomycosis, an infectious disease caused by a fungus, is also associated with dust episodes. The spores of the fungus vaporise into the atmosphere and infect the respiratory tract.

The UN estimates that North Africa and the Middle East lose about US$13 billion in GDP (https://www.unep.org/ru/node/331) each year due to sand and dust storms. “But this is

totally underestimated, we don't evaluate the impact on agricultural productivity, on the loss of soil fertility; nor the consequences for the economy when ports and airports are closed, nor the impact on health," notes Ibrahim Thiaw, secretary general of the United Nations Convention to Combat Desertification (UNCCD) (https://www.unccd.int/).

In the Zabol region of Iran, the cost of dust storms is estimated at €21 million per year, in physical damage and lost productive work hours. "Such economic assessments are few and far between," says Middleton. Zabol is a victim of dust from shallow, swampy lakes straddling the Iran-Afghanistan border, whose waters are diverted for irrigation and domestic use. "To improve Zabol's air quality, the best hope would be an agreement between Iran and Afghanistan to regulate water use in the region," says the British geographer.

Restoring the soil

Predictions remain difficult. "There are many uncertainties. Wind is a fundamental parameter for understanding dust emissions. But we are not very good at predicting what will happen with the wind in our climate models," explains Pérez Garcia-Pando. "We also don't know very well what the effects of climate change and increasingly severe droughts will be on meteorological depressions, on the biological soil crust (https://www.soilcare-project.eu/resources/glossary/all-terms/54:biological-soil-crust) in semi-arid areas that stabilise the surface of the soil and ultimately on sandstorms," adds the researcher.

To mitigate the consequences of these storms, early warning systems coordinated by local weather centres, like those for earthquakes, are being put in place three days before they occur in parts of the world where the technology exists, such as South Korea and North America.

In the Sahel, while weather centres can accurately predict dry fogs several days in advance, they cannot do the same for haboobs. "It is like predicting thunderstorms. It is more difficult to explain and understand. You need satellite tools," says Gaptia Lawan.

If we can't prevent these storms, we can mitigate them. "To deal with this global phenomenon, the response must be global. We have to go to the root cause, which is land

degradation, desertification, loss of vegetation cover. The storm phenomenon is linked to ecological disturbance and to address this issue there is no other solution than to ensure soil fixation, restore ecosystems and replant. We also need to reduce the risks, to sufficiently assess the environmental consequences of dams that deplete ecosystems," argues Thiaw of UNCCD.

Planting trees, matching plants and species to their natural environment, stabilising the dunes – the techniques are known but the work is long term. It is a matter of recovering the soil metre by metre, hectare by hectare. The Great Green Wall (https://www.greatgreenwall.org) to combat desertification in the Sahel is an ambitious initiative. "But it's not just Africa. Large-scale restoration programmes are needed in many parts of the world. And you need the involvement of the private sector. It is part of the problem, it must be part of the solution," says Thiaw.

The promise of land restoration programmes in countries around the world exceeds one billion hectares of land. "In China, vegetation restoration programmes in arid areas, with tree plantations, have changed the cover and hardiness of the soil and there has been a decrease in dust storms over the last 20 years," confirms Pérez Garcia-Pando.

This article has been translated from French by Sara Hammerton

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