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The full report, *The Global Threat of Drying Lands: Regional and global aridity trends and future projections*, is available for media preview at <https://bit.ly/4ePoHZg>

Three-Quarters of Earth's Land Became Permanently Drier in Last Three Decades: UN

Aridity: The 'existential crisis' redefining life on Earth

Five billion people could be affected by 2100

Riyadh, Saudi Arabia – Even as dramatic water-related disasters such as floods and storms intensified in some parts of the world, more than three-quarters of Earth's land became permanently drier in recent decades, UN scientists warned today in a stark new analysis.

Some 77.6% of Earth's land experienced drier conditions during the three decades leading up to 2020 compared to the previous 30-year period, according to the landmark report from the UN Convention to Combat Desertification (UNCCD).

Over the same period, drylands expanded by about 4.3 million km² – an area nearly a third larger than India, the world's 7th largest country – and now cover 40.6% of all land on Earth (excluding Antarctica).

In recent decades some 7.6% of global lands – an area larger than Canada – were pushed across aridity thresholds (i.e. from non-drylands to drylands, or from less arid dryland classes to more arid classes).

Most of these areas have transitioned from humid landscapes to drylands, with dire implications for agriculture, ecosystems, and the people living there.

And the research warns that, if the world fails to curb greenhouse gas emissions, another 3% of the world's humid areas will become drylands by the end of this century.

In high greenhouse gas emissions scenarios, expanding drylands are forecast across the Midwestern United States, central Mexico, northern Venezuela, north-eastern Brazil, south-eastern Argentina, the entire Mediterranean Region, the Black Sea coast, large parts of southern Africa, and southern Australia.

The report, *The Global Threat of Drying Lands: Regional and global aridity trends and future projections*, was launched at the 16th conference of UNCCD's nearly 200 Parties in Riyadh, Saudi Arabia (COP16), the largest UN land conference to date, and the first UNCCD COP to be held in the Middle East, a region profoundly affected by impacts from aridity.

“This analysis finally dispels an uncertainty that has long surrounded global drying trends,” says Ibrahim Thiaw, UNCCD Executive Secretary. “For the first time, the aridity crisis has been documented with scientific clarity, revealing an existential threat affecting billions around the globe.”

“Unlike droughts—temporary periods of low rainfall—aridity represents a permanent, unrelenting transformation,” he adds. “Droughts end. When an area's climate becomes drier, however, the ability to return to previous conditions is lost. The drier climates now affecting vast lands across the globe will not return to how they were and this change is redefining life on Earth.”

The report by UNCCD Science-Policy Interface (SPI) — the UN body for assessing the science of land degradation and drought — points to human-caused climate change as the primary driver of this shift. Greenhouse gas emissions from electricity generation, transport, industry and land use changes warm the planet and other human activities warm the planet and affect rainfall, evaporation and plant life, creating the conditions that increase aridity.

Global aridity index (AI) data track these conditions and reveal widespread change over the decades.

Aridification hotspots

Areas particularly hard-hit by the drying trend include almost all of Europe (95.9% of its land), parts of the western United States, Brazil, parts of Asia (notably eastern Asia), and central Africa.

- **Parts of the Western United States and Brazil:** Significant drying trends, with water scarcity and wildfires becoming perennial hazards.
- **Mediterranean and Southern Europe:** Once considered agricultural breadbaskets, these areas face a stark future as semi-arid conditions expand.
- **Central Africa and parts of Asia:** Biologically megadiverse areas are experiencing ecosystem degradation and desertification, endangering countless species.

By contrast, less than a quarter of the planet's land (22.4%) experienced wetter conditions, with areas in the central United States, Angola's Atlantic coast, and parts of Southeast Asia showing some gains in moisture.

The overarching trend, however, is clear: drylands are expanding, pushing ecosystems and societies to suffer from aridity's life-threatening impacts.

The report names South Sudan and Tanzania as nations with the largest percentage of land transitioning to drylands, and China as the country experiencing the largest total area shifting from non-drylands into drylands.

For the 2.3 billion people – well over 25% of the world's population – living in the expanding drylands, this new normal requires lasting, adaptive solutions. Aridity-related land degradation, known as desertification, represents a dire threat to human well-being and ecological stability.

And as the planet continues to warm, report projections in the worst-case scenario suggest up to 5 billion people could live in drylands by the century's end, grappling with depleted soils, dwindling water resources, and the diminishment or collapse of once-thriving ecosystems.

Forced migration is one of aridity's most visible consequences. As land becomes uninhabitable, families and entire communities facing water scarcity and agricultural collapse often have no choice but to abandon their homes, leading to social and political challenges worldwide. From the Middle East to Africa and South Asia, millions are already on the move—a trend set to intensify in coming decades.

Aridity's devastating impact

The effects of rising aridity are cascading and multifaceted, touching nearly every aspect of life and society, the report says.

It warns that one fifth of all land could experience abrupt ecosystem transformations from rising aridity by the end of the century, causing dramatic shifts (such as forests becoming grasslands and other changes) and leading to extinctions among many of the world's plants, animals and other life.

- Aridity is considered the world's largest single driver behind the degradation of agricultural systems, affecting 40% of Earth's arable lands
- Rising aridity has been blamed for a 12% decline in gross domestic product (GDP) recorded for African countries between 1990–2015
- More than two thirds of all land on the planet (excluding Greenland and Antarctica) is projected to store less water by the end of the century, if greenhouse gas emissions continue to rise even modestly
- Aridity is considered one of the world's five most important causes of land degradation (along with land erosion, salinization, organic carbon loss and vegetation degradation)
- Rising aridity in the Middle East has been linked to the region's more frequent and larger sand and dust storms
- Increasing aridity is expected to play a role in larger and more intense wildfires in the climate-altered future—not least because of its impacts on tree deaths in semi-arid forests and the consequent growing availability of dry biomass for burning
- Rising aridity's impacts on poverty, water scarcity, land degradation and insufficient food production have been linked to increasing rates of sickness and death globally —especially among children and women
- Rising aridity and drought play a key role in increasing human migration around the world—particularly in the hyper-arid and arid areas of southern Europe, the Middle East and North Africa and southern Asia.

Report marks a turning point

For years, documenting the rise of aridity proved a challenge, the report states. Its long-term nature and the intricate interplay of factors such as rainfall, evaporation, and plant transpiration made analysis difficult. Early studies produced conflicting results, often muddied by scientific caution.

The new report marks a turning point, leveraging advanced climate models and standardized methodologies to deliver a definitive assessment of global drying trends, confirming the inexorable rise of aridity, while providing critical insights into its underlying drivers and potential future trajectory.

Recommendations

The report offers a comprehensive roadmap for tackling aridity, emphasizing both mitigation and adaptation. Among its recommendations:

- **Strengthen aridity monitoring**

Integrate aridity metrics into existing drought monitoring systems. This approach would enable early detection of changes and help guide interventions before conditions worsen. Platforms like the new Aridity Visual Information Tool provide policymakers and researchers with valuable data, allowing for early warnings and timely interventions. Standardized assessments can enhance global cooperation and inform local adaptation strategies.

- **Improve land use practices**

Incentivizing sustainable land use systems can mitigate the impacts of rising aridity, particularly in vulnerable regions. Innovative, holistic, sustainable approaches to land management are the focus of another new UNCCD SPI report, *Sustainable Land Use Systems: The path to collectively achieving Land Degradation Neutrality*, available at <https://bit.ly/3ZwkLZ3>. It considers how land-use at one location affect others elsewhere, makes resilience to climate change or other shocks a priority, and encourages participation and buy-in by Indigenous and local communities as well as all levels of government. Projects like the Great Green Wall—a land restoration initiative spanning Africa—demonstrate the potential for large-scale, holistic efforts to combat aridity and restore ecosystems, while creating jobs and stabilizing economies.

- **Invest in water efficiency**

Technologies such as rainwater harvesting, drip irrigation, and wastewater recycling offer practical solutions for managing scarce water resources in dry regions.

- **Build resilience in vulnerable communities**

Local knowledge, capacity building, social justice and holistic thinking are vital to resilience. Sustainable land use systems encourage decision makers to apply responsible governance, protect human rights (including secure land access) and ensure accountability and transparency. Capacity-building programmes, financial support, education programmes, climate information services and community-driven initiatives empower those most affected by aridity to adapt to changing conditions. Farmers switching to drought-resistant crops or pastoralists adopting more arid-tolerant livestock exemplify incremental adaptation.

- **Develop international frameworks and cooperation**

The UNCCD's Land Degradation Neutrality framework provides a model for aligning national policies with international goals, ensuring a unified response to the crisis. National Adaptation Plans must incorporate aridity alongside drought planning to create

cohesive strategies that address water and land management challenges. Cross-sectoral collaboration at the global level, facilitated by frameworks like the UNCCD, is essential for scaling solutions.

Comments

“For decades, the world’s scientists have signalled that our growing greenhouse gas emissions are behind global warming. Now, for the first time, a UN scientific body is warning that burning fossil fuels is causing permanent drying across much of the world, too—with potentially catastrophic impacts affecting access to water that could push people and nature even closer to disastrous tipping points. As large tracts of the world’s land become more arid, the consequences of inaction grow increasingly dire and adaptation is no longer optional—it is imperative.”

- ***UNCCD Chief Scientist Barron Orr***

“Without concerted efforts, billions face a future marked by hunger, displacement, and economic decline. Yet, by embracing innovative solutions and fostering global solidarity, humanity can rise to meet this challenge. The question is not whether we have the tools to respond—it is whether we have the will to act.”

- ***Nichole Barger, Chair, UNCCD Science-Policy Interface***

“The report’s clarity is a wake-up call for policymakers: tackling aridity demands more than just science—it requires a diversity of perspectives and knowledge systems. By weaving Indigenous and local knowledge with cutting-edge data, we can craft stronger, smarter strategies to slow aridity’s advance, mitigate its impacts and thrive in a drying world.”

- ***Sergio Vicente-Serrano, co-lead author of the report and an aridity expert with Spain’s Pyrenean Institute of Ecology***

“This report underscores the critical need to address aridity as a defining global challenge of our time. By uniting diverse expertise and leveraging breakthrough technologies, we are not just measuring change—we are crafting a roadmap for resilience. Tackling aridity demands a collaborative vision that integrates innovation, adaptive solutions, and a commitment to securing a sustainable future for all.”

- ***Narcisa Pricope, co-lead author, professor of geosciences and associate vice president for research at Mississippi State University, USA.***

“The timeliness of this report cannot be overstated. Rising aridity will reshape the global landscape, challenging traditional ways of life and forcing societies to reimagine their

relationship with land and water. As with climate change and biodiversity loss, addressing aridity requires coordinated international action and an unwavering commitment to sustainable development.”

- *Andrea Toreti, co-lead author and senior scientist, European Commission’s Joint Research Centre*

By the Numbers:

Key global trends / projections

1. **77.6%:** Proportion of Earth's land that experienced drier climates from 1990–2020 compared to the previous 30 years.
2. **40.6%:** Global land mass (excluding Antarctica) classified as drylands, up from 37.5% over the last 30 years.
3. **4.3 million km²:** Humid lands transformed into drylands in the last three decades, an area one-third larger than India
4. **40%:** Global arable land affected by aridity—the leading driver of agricultural degradation.
5. **30.9%:** Global population living in drylands in 2020, up from 22.5% in 1990
6. **2.3 billion:** People living in drylands in 2020, a doubling from 1990, projected to more than double again by 2100 under a worst-case climate change scenario.
7. **1.35 billion:** Dryland inhabitants in Asia—more than half the global total.
8. **620 million:** Dryland inhabitants in Africa—nearly half of the continent’s population.
9. **9.1%:** Portion of Earth’s land classified as hyperarid, including the Atacama (Chile), Sahara (Africa), Namib (Africa), and Gobi (China/Mongolia) deserts.
10. **23%:** Increase in global land at "moderate" to "very high" desertification risk by 2100 under the worst-case emissions scenario
 - a. **+8%** at "very high" risk.
 - b. **+5%** at "high" risk.
 - c. **+10%** at "moderate" risk.

Environmental degradation

- **5:** Key drivers of land degradation: Rising aridity, land erosion, salinization, organic carbon loss, and vegetation degradation
- **20%:** Global land at risk of abrupt ecosystem transformations by 2100 due to rising aridity
- **55%:** Species (mammals, reptiles, fish, amphibians, and birds) at risk of habitat loss from aridity. *Hotspots:* (Arid regions): West Africa, Western Australia, Iberian Peninsula; (Humid regions): Southern Mexico, northern Amazon rainforest

Economics

- **12%:** African GDP decline attributed to aridity, 1990–2015
- **16% / 6.7%:** Projected GDP losses in Africa / Asia by 2079 under a moderate emissions scenario
- **20M tons maize, 21M tons wheat, 19M tons rice:** Expected losses in global crop yields by 2040 due to expanding aridity
- **50%:** Projected drop in maize yields in Kenya by 2050 under a high emissions scenario

Water

- **90%:** Rainfall in drylands that evaporates back into the atmosphere, leaving 10% for plant growth
- **67%:** Global land expected to store less water by 2100, even under moderate emission scenarios
- **75%:** Decline in water availability in the Middle East and North Africa since the 1950s
- **40%:** Predicted Andean runoff decline by 2100 under a high emissions scenario, threatening water supplies in South America

Health

- **55%:** Increase in severe child stunting in sub-Saharan Africa under a medium emissions scenario due to combined effects of aridity and climate warming
- **Up to 12.5%:** Estimated rise in mortality risks during sand and dust storms in China, 2013–2018
- **57% / 38%:** Increases in fine and coarse atmospheric dust levels, respectively, in the southwestern U.S. by 2100 under worst case climate scenarios
- **220%:** Projected increase in premature deaths due to airborne dust in the southwestern United States by 2100 under the high-emissions scenario
- **160%:** Expected rise in hospitalizations linked to airborne dust in the same region

Wildfires and Forests

- **74%:** Expected increase in wildfire-burned areas in California by 2100 under high emission scenarios
- **40:** Additional annual high fire danger days in Greece by 2100 compared to late 20th century levels

Notes to editors:

Aridity versus drought

Highly arid regions are places in which a persistent, long-term climatic condition lacks available moisture to support most forms of life and atmospheric evaporative demand significantly exceeds rainfall.

Drought, on the other hand, is an anomalous, shorter-term period of water shortage affecting ecosystems and people and often attributed to low precipitation, high temperatures, low air humidity and/or anomalies in wind.

While drought is part of natural climate variability and can occur in almost any climatic regime, aridity is a stable condition for which changes occur over extremely long-time scales under significant forcing.