

## Environmental Issues of Destructive Megadroughts

**Madraim Khasanovich Sarikulov**

Associate Professor, Almalyk State Technical Institute, Almalyk, Uzbekistan  
[sarikulov.madraim4@gmail.com](mailto:sarikulov.madraim4@gmail.com)

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**Annotation:** This article examines the environmental issues of devastating megadroughts against the backdrop of air pollution and water shortages worldwide, as well as the state of the environment, which has begun to threaten the quality of life and the very existence of human society. The world is currently facing a growing threat – devastating megadroughts with prolonged periods of complete lack of precipitation that last for years. It is also noted that the drying up of lakes, which turn into lifeless expanses – deserts – is considered particularly dangerous.

**Keywords:** Environmental disaster, consequences of megadrought, water crises, energy production, water shortages, global warming, environmental runoff, tropical forests, agricultural production, Lake Urmia.

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### INTRODUCTION

Modern environmental problems are changes in nature that disrupt its structure and functioning. The root cause of the international environmental crisis lies in the increasing human conquest of nature and the development of new technologies that have completely transformed the face of the planet. This has also been influenced by the growing population, unevenly distributed across the continents. Overpopulation resulting from the population explosion in underdeveloped Asian and South American countries is forcing the expansion of spaces taken from nature.

The uncontrolled and reckless use of scientific advances and the proliferation of large industrial

enterprises, while beneficial, have caused significant harm to the environment, leading to widespread pollution of water, air, and soil. Under the influence of negative human impacts on nature, the structure of the natural landscape is being distorted, and natural resources are being depleted.

## LITERARY RESEARCH

Human encroachment on nature, its callous exploitation over centuries, especially since the onset of the Industrial Revolution, has led to the state of the environment threatening the quality of life and the very existence of human society. Over the past two decades, a huge number of localized environmental disasters have occurred, negatively impacting the environment. Humans return the benefits they receive from nature to it in a degraded form, resulting in the pollution of the planet. And this process is increasing every year. For several generations, people have been sounding the alarm, trying to draw attention to these issues. The world is now facing a growing threat: extreme megadroughts. Research shows that their frequency and intensity are increasing across the globe.

Ecology as a science can offer solutions to this growing crisis. It is ecology that reveals the laws of relationships that form the basis for the sustainable development of society. At the same time, it is essential that the population consciously understand the importance of improving their relationship with nature and strict adherence to the rules and principles of proper stewardship of Mother Earth's resources and wealth. Only by strictly adhering to all precautionary measures will a high level of environmental awareness be fostered and developed in society.

Referring to the website [1], we can state that the trend toward increasing megadroughts is clear: a team of researchers has created the first global—and globally consistent—high-resolution picture of megadroughts and their impact on vegetation. However, the long-term consequences for the planet and its ecosystems remain largely unknown. Meanwhile, the data is already consistent with the observed widespread greening of the Arctic. "However, in the event of prolonged extreme water shortages, trees in tropical and northern regions could die, causing long-term damage to these ecosystems. "In particular, boreal vegetation will likely take longer to recover from such a climate catastrophe," says Karger. Pellicciotti hopes the team's findings will help change the way we think about droughts and how to prepare for them: "Currently, mitigation strategies mostly treat droughts as annual or seasonal events, which contrasts sharply with the longer-lasting and more severe megadroughts we will face in the future," she says. "We hope that the publicly accessible drought inventory we are publishing will help guide policymakers in taking more realistic preparedness and prevention measures." As a glaciologist, Pellicciotti also aims to study the impacts of megadroughts in mountains and how glaciers can mitigate their effects. She leads a collaborative project called "MegaWat – Megadroughts in European Catchments – From Understanding Processes to Management and Adaptation Strategies."

Source materials [2] note that rising global temperatures result in rising sea levels, changes in the amount and nature of precipitation, and the expansion of deserts. Other consequences of global warming include: increased frequency of extreme weather events, including heat waves, droughts, and heavy rains; ocean acidification; and the extinction of species due to temperature changes. Significant consequences for humanity include threats to food security due to negative impacts on crop yields (especially in Asia and Africa) and habitat loss due to rising sea levels.

According to [3], water scarcity is a growing concern in many parts of the world. Population growth, urbanization, increasing demand for irrigated agriculture, and poor water management are important factors driving water scarcity, which is exacerbated by the impact of climate change, which is increasing the frequency and severity of droughts. Today, approximately 2 billion people live in water-stressed areas. By the end of 2025, half the world's population is expected to face this situation. It is projected that every 1°C increase in temperature caused by global warming will reduce renewable water resources by 20%. Water scarcity has serious consequences for society and threatens the sustainability of development. For example, water scarcity can negatively impact the provision of water supply and sanitation services and affect human health. Insufficient safe

drinking water can compromise adequate hygiene and increase the risk of diarrhea. Water scarcity can also limit economic growth by reducing agricultural production, impact the environment and biodiversity by reducing environmental flows necessary for ecosystem health, and lead to conflicts within and between countries and increased migration flows.

According to the website [4], a fifteen-year, sustained and devastating megadrought—the longest in a thousand years—has almost completely depleted Chile's water reserves (Fig. 1) and even impacted the country's vital mining operations. This is just one glaring example of how climate warming is leading to multi-year droughts and acute water crises in vulnerable regions around the world. However, droughts are typically only noticed when they damage agriculture or significantly impact forests. This raises a number of pressing questions: Can we consistently identify extreme multi-year droughts and study their impact on ecosystems? And what can we learn from the droughts of the past forty years? To answer these questions, researchers from the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) and the Institute of Science and Technology Austria (ISTA) analyzed global meteorological data and modeled droughts between 1980 and 2018. They demonstrated an alarming increase in the number of multi-year droughts, which have become longer, more frequent, more extreme, and have affected larger areas. "Since 1980, drought-affected areas have increased by an average of 50,000 square kilometers each year—roughly the size of Slovakia or the combined US states of Vermont and New Hampshire—causing enormous damage to ecosystems, agriculture, and energy production," says ISTA Professor Francesca Pellicciotti, principal investigator of the WSL-funded EMERGE project, which conducted the current study. The team aims to identify the potential long-term impacts of prolonged droughts worldwide and help develop strategies to prepare for more frequent and severe megadroughts in the future.



**Figure 1. Illustration of the drying up of the Yeso reservoir in central Chile during the peak of the megadrought in summer 2020. (© Vicente Melo Velasco/ISTA).**

Scientists continue to attempt to understand [5] the nature of this climate phenomenon and its impact on human life. Five hundred years ago, everything began exactly as it does now. Not a drop of rain fell in northern Italy. Italian historical records indicate that there was no precipitation

for two hundred consecutive days. The drought then spread throughout Europe. As a result, deep rivers such as the Seine, Rhine, and Elbe dried up to the point where they could be easily forded. The Thames became so shallow that the sea began to flow inland and change the river's course.

The website [6] notes that three million hectares of agricultural land were affected by the drought. This was reported by the Ministry of Water Resources of the People's Republic of China, as reported by the Xinhua News Agency. According to the agency, the drought affected three million hectares of agricultural land in China. Meanwhile, approximately 200,000 people and 760,000 head of cattle are facing drinking water shortages due to drought. The drought has primarily affected the northern and northeastern regions of the country—Hebei and Liaoning provinces and the Inner Mongolia Autonomous Region. Last week, northern China experienced a heat wave, prompting a red alert for maximum weather conditions.

## Methodology

Continuously rising temperatures, prolonged droughts, and higher evapotranspiration ultimately cause ecosystems to become drier and browner, despite also causing heavier precipitation. Therefore, scientists can use satellite imagery to monitor the effects of drought by tracking changes in vegetation greenness over time. While this analysis is well suited for grasslands in temperate climates, changes in greenness are not as easily tracked in dense tropical forests, leading to underestimation of drought impacts in such areas.

It should be noted that the planet's climate has been rapidly changing since the mid-20th century. Scientists have long been sounding the alarm: rising temperatures intensify storms, floods, and droughts. Devastating megadroughts—long periods of almost complete lack of precipitation that last for years—are particularly dangerous. For example, Chile is experiencing one of the longest droughts in history, which has lasted since 2010. It deprives the region of water, destroys crops, and even impacts mining operations. Droughts typically become noticeable only when they cause significant damage to agriculture or forests.

An international team of scientists set out to discover how to predict droughts and their changes. To do this, they analyzed climate data and modeled droughts from 1980 to 2019. The scientists assessed anomalies in precipitation and water evaporation from soil and plants. They then globally mapped 13,176 precipitation events during the study period. It turned out that since 1980, the area affected by megadroughts has increased by approximately 50,000 square kilometers annually, equivalent to the size of Slovakia. Droughts are becoming longer, hotter, and spreading to new regions. Temperate grasslands and pastures are the hardest hit, including those in the western United States, Mongolia, and southeastern Australia. However, tropical and boreal forests remain drought-resistant. Trees in the tropics use stored water from the soil, and warming in boreal forests even extends their growing season, as it depends on temperature rather than water availability. The authors not only documented known megadroughts but also identified new, previously unnoticed ones. For example, the drought that lasted from 2010 to 2018 in the tropical forests of Congo remained under the radar of scientists due to the difficulty of monitoring dense forest ecosystems. In the future, the researchers plan to learn more about the impacts of megadroughts in mountainous areas and determine the role of glaciers in mitigating the effects of aridity.

One example of a devastating megadrought is the drying up of Lake Urmia, the largest salt lake in the Middle East, turning it into a desert. This environmental disaster was caused by global warming and the construction of dams on the rivers that feed it. According to experts, the lakebed contains approximately 10 billion tons of salt. The faults that formed in the lakebed were caused by an earthquake. Until recently, this beach attracted millions of tourists.

## Conclusions

Thus, it can be concluded that devastating megadroughts are not just a climatological theory. They are a real threat that humanity must confront. The question is whether we are ready to accept the challenge and change our attitude toward nature to prevent a planetary-scale catastrophe.

Based on the above, it can be concluded that devastating megadroughts pose a major threat to the environment and can cause significant harm to the human population and other living organisms, as well as to the ecosystem as a whole. The more people join in solving the environmental problems of devastating megadroughts, the greater the benefit to society. I believe that if we want to live in an ecologically healthy country, breathe fresh air, and drink clean water, we must take all measures to reduce the impact of devastating megadroughts on the environment.

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