

New UN University report warns about risk tipping points with irreversible impacts on people and planet

A United Nations University report released today finds that drastic changes are approaching if risks to our fundamental socioecological systems are not addressed.

The [*Interconnected Disaster Risks Report 2023*](#) published by the United Nations University – Institute for Environment and Human Security (UNU-EHS) warns of six risk tipping points ahead of us:

- Accelerating extinctions
- Groundwater depletion
- Mountain glaciers melting
- Space debris
- Unbearable heat
- Uninsurable future

Systems are all around us and closely connected to us: ecosystems, food systems, water systems and more. When they deteriorate, it is typically not a simple and predictable process. Rather, instability slowly builds until suddenly a tipping point is reached and the system changes fundamentally or even collapses, with potentially catastrophic impacts.

A risk tipping point is defined in the report as the moment at which a given socioecological system is no longer able to buffer risks and provide its expected functions, after which the risk of catastrophic impacts to these systems increases substantially. These diverse cases illustrate that risk tipping points extend beyond the single domains of climate, ecosystems, society or technology. Instead, they are inherently interconnected, and they are also closely linked to human activities and livelihoods.

Many new risks emerge when and where our physical and natural worlds interconnect with human society. One example of a risk tipping point that the report explains is groundwater depletion. Underground water reservoirs called aquifers are an essential freshwater resource around the world, and they supply drinking water to over 2 billion people. Around 70 per cent of groundwater withdrawals are used for agriculture, oftentimes when there is not sufficient water from above-ground sources available. Today, aquifers help to mitigate half of the losses in agriculture caused by drought, a phenomenon which is only expected to increase in the future due to climate change. But the report warns that now it's the aquifers themselves that are approaching a tipping point:

More than half of the world's major aquifers are being depleted faster than they can be naturally replenished. If the water table falls below a level that existing wells can access, farmers can suddenly find themselves without the ability to access water, which puts entire food production systems at risk of failure. Some countries, such as Saudi Arabia, have already surpassed this groundwater risk tipping point, others, like India, are not far from it.

"As we indiscriminately extract our water resources, damage nature and biodiversity, and pollute both Earth and space, we are moving dangerously close to the brink of multiple risk tipping points that could destroy the very systems that our life depends on," said Dr. Zita Sebesvari, Lead Author of the *Interconnected Disaster Risks Report* and Deputy Director of UNU-EHS. "Additionally, we also lose some of our tools and options to deal with future disaster risk."

The analysis reveals the cases share similar root causes and drivers which are embedded in our actions and behaviours that increasingly put pressure on our systems until they are pushed to the brink of collapse. Reaching these points means new risks will be introduced, many of which we do not yet know of.

"As we approach these tipping points, we will already begin to experience the impacts. Once, crossed it will be difficult to go back," warned Dr. Jack O'Connor, Lead Author and Senior Expert at UNU-EHS. "Our report can help us see risks ahead of us, the causes behind them, and the urgent changes required to avoid them."

The report does not just define and identify risk tipping points, but it also proposes a new framework to avoid or mitigate the consequences. Solutions fall into two categories: *Avoid* solutions, which target root causes and drivers of risk to avoid risk tipping points altogether and *Adapt* solutions, which help prepare or better address the negative impacts of risk tipping points if they cannot be avoided.

For both *Avoid* and *Adapt* solutions, there are two type of actions. *Delay* actions work within the existing "business as usual" system and aim to slow down the progression toward risk tipping points or the worst impacts. But the ideal action is to *Transform*, which involves a fundamental reimagining of a system into something stronger and more sustainable than before.

In the case of the "Unbearable heat" risk tipping point described in the report, it is human-induced climate change that is causing a global rise in temperatures, leading to more frequent and intense heat-waves that will in some areas reach temperatures in which the human body can no longer survive. An *Adapt-Delay* solution would aim to counteract this risk by installing air conditioners, for example. The air conditioners will delay when the risk tipping point is reached for the people in the area, but will not address the heat itself. An *Avoid-Transform* solution, on the other hand, would aim to halt the emissions of greenhouse gasses and at the same time drive societal change toward low-carbon ways of living so the tipping point can ultimately be avoided.

The report finds that solutions being implemented today tend to focus on *Delay* rather than *Transform*, although increasing focus is being put on transformative change to achieve global goals on transitioning to a more sustainable future. It will require more game-changing solutions to move us away from a future of multiplying risk tipping points.

Transformative solutions will also require considerable societal and personal effort, and the report highlights overall changes we can each make to our behaviours and values.

“Real transformative change involves everyone,” said Sebesvari. “The report serves as a timely reminder before the UN Climate Conference that we must all be part of the solution.”

Notes to Editors

High-resolution photography is available [here](#).

Courtesy translations of this media release available in Spanish and German will be made available [here](#).

Short summaries of the 6 risk tipping points see annex below.

Technical background reports on each tipping point available upon request.

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About the Interconnected Disaster Risks report (#InterconnectedRisks)

Interconnected Disaster Risks is an annual science-based report designed to be accessible for the general public. It is published by the United Nations University – Institute for Environment and Human Security, and was first released in 2021. The idea for the report was developed based on the recognition that disasters are occurring at an ever-faster rate and, despite progress being made in how we prepare and respond to them, we are continuously being caught out by new extremes and new emerging threats. The report analyses several concrete examples of disasters each year and explains how they are interconnected with each other and with human actions. It seeks to shed light on the interconnections that might otherwise be missed, and describes how we can develop solutions to use these connections to our advantage. The report is based on thorough scientific analysis and includes technical background reports for each of the cases, which together with the main report and executive summary are made available on interconnectedrisks.org.

About the United Nations University – Institute for Environment and Human Security (UNU-EHS)

Based in Bonn, Germany, UNU-EHS conducts research on risks and adaptation related to environmental hazards and global change. The institute's research promotes policies and programmes to reduce these risks, while taking into account the interplay between environmental and societal factors. Research areas include climate change adaptation by incorporating insurance-related approaches, environmentally-induced migration and social vulnerability, ecosystem-based solutions to adaptation and disaster risk reduction, and models and tools to analyse vulnerability and risks linked to natural hazards, with a focus on urban space and rural-urban interfaces.

UNU-EHS also offers the joint Master of Science degree programme "Geography of Environmental Risks and Human Security" with the University of Bonn and hosts international PhD projects and courses on global issues of environmental risks and sustainable development.

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Background: Brief summaries of the 6 risk tipping points included in the report**Accelerating extinctions:**

Intense human activities – including land use change, overexploitation, climate change, pollution and introduction of invasive alien species – have created a rate of species extinction at least 10 to 100 times Earth's natural rate.

Ecosystems are built on intricate connections between species. If one species goes extinct, it can have knock-on effects on many others. The risk tipping point in this context is when an ecosystem loses key species that are strongly connected, triggering cascading extinctions of dependent species, which can eventually lead to the collapse of an entire ecosystem.

An example is the gopher tortoise, which digs burrows that are used by more than 350 other species for breeding, feeding, protection from predators and avoiding extreme temperatures. One of these species is the endangered dusky gopher frog. If the gopher tortoise goes extinct, as foreseen, the dusky gopher frog is one species that will likely follow. But because the dusky gopher frog helps control insect populations and prevent pest outbreaks in longleaf pine forest ponds, its extinction would again trigger a number of negative effects that may become unstoppable.

Groundwater depletion:

The risk tipping point in this context is the loss of access to freshwater resources in underground reservoirs known as aquifers.

Aquifers supply drinking water to over 2 billion people, and around 70 per cent of withdrawals are used for agriculture. More than half of the world's major aquifers are being depleted faster than they can be naturally replenished. The tipping point in this case is reached when the water table falls below a level that existing wells can access, putting entire food production systems at risk of failure.

Some countries have already experienced the effects. Saudi Arabia was the world's 6th-largest wheat exporter in the mid-1990s based on large-scale groundwater extraction for irrigation, but wells ran dry and the nation had to turn to wheat imports. India and other countries are currently nearing this risk tipping point, with global impacts expected to ripple through the world's food systems, economy and environment. Also affected are the very structure of society, the well-being of future generations, and the ability to manage future agricultural losses due to climate change-driven drought.

Mountain glaciers melting:

Glaciers retreat when the ice mass that formed many years ago melts faster than it is replaced by snow. Due to global warming, the world's glaciers are now melting twice as fast than they did in the past two decades. Between 2000 and 2019, glaciers lost 267 gigatons of ice per year, which is roughly equivalent to the mass of 46,500 Great Pyramids of Giza.

Glaciers store large amounts of freshwater. Meltwater from glaciers and snow supplies water for drinking, irrigation, hydropower and ecosystems to entire regions. The risk tipping point in this context is “peak water” – the point when a glacier produces the maximum volume of water run-off due to melting. After this point, freshwater availability will steadily decline.

Peak water has been reached or is expected to occur within the next 10 years for many small glaciers in Central Europe, Western Canada and South America. In the Andes, where peak water has already passed for many glaciers, communities are grappling with unreliable water sources for drinking and irrigation. For example, Peru’s Quelccaya glacier, once the world’s largest tropical ice cap, has shrunk by 31 per cent in the last 30 years contributing to periodic dry season water scarcity and widespread impacts.

An estimated 90,000+ glaciers of the Himalayas, Karakorum and Hindu Kush mountains are currently at risk of reaching the tipping point, threatening the nearly 870 million people that rely on them.

Space debris:

Space has a garbage problem. This is because when satellites become defunct, they are left in the Earth’s orbit as space debris. Out of 34,260 objects tracked in orbit today, only around 25 per cent are working satellites. The rest are junk – broken satellites or discarded rocket stages. Additionally, there are likely around 130 million pieces of debris too small to be tracked, measuring between 1 mm and 1 cm.

Space debris travels at over 25,000 km per hour, and even the smallest debris can cause significant damage if it collides with something, creating even more debris. This is why other objects, such as the International Space Station or satellites, need to regularly conduct maneuvers to avoid it. The problem worsens as more and more objects are launched into space and debris accumulates.

The risk tipping point in this context is the point at which the Earth’s orbit becomes so full of debris that one collision sets off a chain reaction of collisions. If that were to happen, the orbit could become unusable, which would threaten our ability to operate satellites, for example to monitor the weather and environmental changes, and to receive early disaster warnings.

More than 100,000 new spacecraft could be launched into orbit by 2030, greatly increasing the risk of this tipping point.

Unbearable heat:

Human-induced climate change is causing a global rise in temperatures, leading to more frequent and intense heatwaves, and this is only expected to become more severe. Extreme heat was responsible for an average of 500,000 excess deaths annually in the last two decades, disproportionately affecting those who are particularly vulnerable due to their age, health conditions or profession, for example. There are weather stations in the world that have already recorded temperatures beyond the tipping point for what a human body can survive in. If this threshold is crossed for more than six hours, even a young and healthy body will suffer extreme consequences.

The tipping point in this context is a so-called “wet-bulb temperature” above 35°C. A wet-bulb temperature is a measurement which combines temperature and humidity, relevant because high humidity worsens the effects of heat as it hinders the evaporation of sweat, which is needed to maintain a stable core body temperature and avoid organ failure and brain damage.

Wet-bulb temperatures have crossed this critical threshold in at least two weather stations, one in the Persian Gulf and one in the Indus River Basin. Research indicates that by 2070, parts of South Asia and the Middle East will regularly surpass this threshold. By 2100 more than 70 per cent of the global population may be exposed to deadly climate conditions for at least 20 days per year.

Uninsurable future:

Since the 1970s, damages as a result of weather-related disasters have increased sevenfold, with 2022 alone seeing \$313 billion in global economic losses and severe disasters forecast to double globally by 2040. Additionally, the number and size of at-risk areas are predicted to expand as climate change shifts the range of hazards like wildfires and storms into new areas.

These changes also affect the insurance industry. Where extreme weather events increasingly wreak havoc, insurance premiums have climbed as much as 57 per cent since 2015, and some insurance companies in at-risk areas have decided to limit the amount or type of damages they can cover, cancel policies or leave the market altogether. For instance, it is predicted that more than half a million Australian homes will be uninsurable by 2030, primarily due to increasing flood risk.

The risk tipping point in this context is reached when insurance becomes unavailable or unaffordable, leaving people without an economic safety net when disasters strike, which opens the door to increasing socioeconomic consequences, particularly when it is the most vulnerable parts of the population that cannot afford to move to safer areas.