

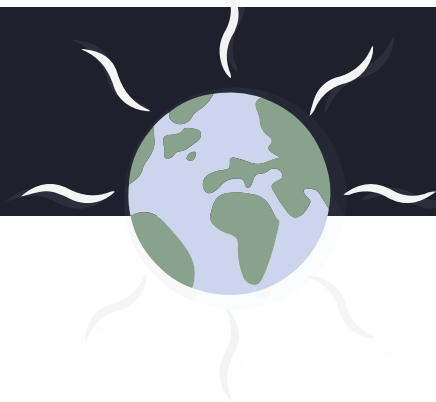
Climate change and the human rights to water and sanitation

**Special Thematic Report 1:
Outlining the impacts of
climate change on water and
sanitation around the world**

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**Special Rapporteur on the human rights
to safe drinking water and sanitation,
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Introduction

It is widely understood and acknowledged that climate change arises as a consequence of the massive emission of greenhouse gases, and therefore no one doubts that mitigation strategies must be led by the energy transition. However, it is rarely explained that the main socio-economic impacts are generated around water. Therefore, adaptation strategies must be based on a hydrological transition that strengthens environmental and social resilience in the face of climate change. On the one hand, it is urgent to recover the health of wetlands and underground aquifers - true natural lungs of the water cycle - which can and should be strategic reserves for increasingly severe droughts. On the other hand, it is a matter of strengthening democratic governance of water and sanitation services as well as aquatic ecosystems in the face of these droughts, with adaptation plans that prioritize the human rights to drinking water and sanitation, particularly for those living in poverty and vulnerable situations and that have been adapted and implemented with the participation of the affected population.

The current report is part of three special thematic reports issued by the Special Rapporteur on the human rights to safe drinking water and sanitation. It serves as an intermittent report between the Special Rapporteur's report to the 48th session of the Human Rights Council in September 2021, focused on his plans and vision for the mandate (A/HRC/48/50) and his next report to the 51st session of the Human Rights Council in September 2022. The current report aims to outline how climate change will impact the human rights to safe drinking water and sanitation, and to describe the main trends in those impacts by region. The second report explores the impacts of climate change on the human rights to safe drinking water and sanitation of specific groups, and the third outlines a human rights approach to climate adaptation, mitigation, financing and cooperation.

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Climate change and human rights

In 2008, the Human Rights Council (HRC) expressed concerns that climate change "poses an immediate and far-reaching threat to people and communities around the world" (resolution 7/23). In a further resolution in March 2009, resolution 10/4, the Council noted that the impacts of climate change on human rights "will be felt most acutely by those segments of the population who are already in a vulnerable situation".

Subsequently, a series of HRC resolutions and reports affirmed the impact of climate change on human rights and the need for human rights mechanisms to strengthen responses to climate change, as well as highlighted the disproportionate impact of climate change on the human rights of certain groups, including women and girls, children, migrants, persons with disabilities, and older persons. The links between climate change and human rights, as well as State obligations to protect human rights from the impacts of climate change, have also been explored by many Special Procedures mandate holders, and treaty bodies, many of which referred to the impact of climate change on the human rights to safe drinking water and sanitation.

In October 2021, the Human Rights Council passed resolution 48/13, in which it recognized that the human rights to a clean, healthy and sustainable environment. A safe climate and safe and sufficient water are both substantive elements of the right to a clean, healthy and sustainable environment. At the same session, the Human Rights Council established the mandate of a Special Rapporteur on the protection of human rights in the context of climate change in resolution 48/14.

Climate change and water and sanitation

The IPCC introduces several impacts of climate change on hydrological systems across the world.* Some of those impacts are illustrated in the current report. First, climate change is projected to reduce renewable surface water and groundwater resources significantly in most arid and semi-arid regions. It has been estimated that about 8 per cent of the global population will see a severe reduction in water resources with a 1°C rise in the global mean temperature, the estimation rising to 14 per cent with a 2°C rise. Second, precipitation variability will increase – , which means, on the one hand, growing risks of heavy rainfall and storms, with stronger river flood peaks, higher flood risks and intensified soil erosion; and on the other hand, more intense and longer droughts. Third, climate change is projected to increase the frequency and intensity of extreme events, including cyclones, hurricanes, and monsoons, destroying local water and sanitation infrastructure. Fourth, sea-level rise is predicted to increase the salinization of coastal aquifers. Finally, the temperature rise will lead to increase in evapotranspiration of vegetation, reducing river flows and favouring the concentration of contaminants in water and the biological processes of eutrophication of water bodies.

The hydrological impacts of climate change cannot be separated from the socio-economic context in which they occur. The risks will worsen with population growth if there is no adequate hydrological, territorial and urban planning that allows for good governance of water and aquatic ecosystems.

*For all references, please see the full text of the report.



Climate change and the human rights to safe drinking water and sanitation

The human rights to safe drinking water was recognized by the UN General Assembly (resolution 64/292) and the Human Rights Council (resolution 15/9). In its General Comment No. 15, the Committee on Economic, Social and Cultural Rights clarified that the human right to water means that everyone is entitled to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses.

In its General Comment No. 15, the Committee on Economic, Social and Cultural Rights (CESCR) outlines that “States parties should adopt comprehensive and integrated strategies and programmes to ensure that there is sufficient and safe water for present and future generations”, including by “assessing the impacts of actions that may impinge upon water availability and natural-ecosystems watersheds, such as climate changes, desertification and increased soil salinity, deforestation and loss of biodiversity”.

In 2010, the Independent Expert on the human right to water and sanitation, Catarina de Albuquerque, wrote a position paper highlighting the impacts of climate change on the normative content of the human rights to water and sanitation. Her findings are summarized below:

Explanation of normative content	Impact of climate change
<p>Availability holds that the water supply for each person must be sufficient and continuous for personal and domestic uses. These uses ordinarily include drinking, sanitation, washing of clothes, food preparation, personal and household hygiene.</p>	<p>Water availability will be threatened by increased water scarcity and competition for resources.</p>
<p>Quality means that the water required for each personal or domestic use must be safe and free from contaminants that threaten health. Water should be of an acceptable colour, odour and taste for each personal or domestic use.</p>	<p>Water quality will decline through overexploitation of groundwater and increased concentration of pollutants.</p>
<p>Accessibility means water facilities and services have to be accessible to everyone without discrimination. Accessibility has four overlapping dimensions: physical accessibility, economic accessibility, non-discrimination, and information accessibility.</p>	<p>The accessibility of water and sanitation services will be threatened through widespread damage and infrastructure due to flooding and extreme events.</p>
<p>Affordability means that access to sanitation facilities and services, including construction, emptying and maintenance, must be available at a price that is affordable for all people without limiting their capacity to access other human rights.</p>	<p>The affordability of water services may decline as increased competition between uses of water leads to rising costs.</p>
<p>Acceptability means that water and sanitation services must be culturally acceptable. This includes that they should be safe, and ensure privacy and dignity.</p>	<p>Under increasing stress, it is likely that the cultural acceptability of water and sanitation services is not prioritized and is in some cases ignored.</p>

The impacts of climate change on water and sanitation

Changing patterns of precipitation

On a global scale, rising temperatures will lead to increased evaporation of surface water. This means that more water from the water cycle will be held in the atmosphere, and average precipitation will increase. In addition to changes at local and regional levels, the amount of precipitation falling at once will become increasingly unpredictable and variable over the year. While the average global yearly precipitation is expected to increase, precipitation is not necessarily going to become more frequent, but rather more intense. In fact, periods of lower precipitation and droughts are expected to become more severe and longer, while periods of precipitation, storms and hurricanes will become more intense.



Impacts on the human rights to safe drinking water and sanitation

- Increased overexploitation of water during periods of low rainfall.
- Need for adaptation measures that diversify sources of supply, strengthen storage and storm drainage.
- Disrupted agricultural and livestock production traditions essential to the food sufficiency.
- Scarcity of resources and conflicts between users with the risk of marginalizing the human rights of the most impoverished and vulnerable.



Droughts

Periods of drought, during which precipitation is greatly reduced and water sources are depleted, are predicted to become longer and more frequent in certain regions of the world which already face overall dry conditions, and dry seasons.

Impacts on the human rights to safe drinking water and sanitation

- Droughts reduce water availability, which can lead to water supply restrictions and marginalize the human rights of the most vulnerable.
- The decrease in flow rates can increase the concentration of pollutants, threatening the drinkability of the water.
- In arid and semi-arid regions, droughts often dry up springs and force people, generally women and girls, to fetch water from more distant sources, with the effort and time that this entails.

Floods



During 1995-2015, floods accounted for 43 per cent of all documented natural disasters, affecting 2.3 billion people. Climate change is projected to increase flood hazards over more than half the planet, both through increased heavy rainfall, and increases in the intensity and frequency of cyclones, hurricanes and tropical storms. These risks can be exacerbated particularly in small catchment areas and drainage basins, as larger basins have more capacity for integrating sudden increases in river flows.

Impacts on the human rights to safe drinking water and sanitation

- Infrastructure can be damaged or destroyed, with important consequences for the availability and accessibility of water and sanitation services.
- Water quality can be threatened by pollutants such as pesticides and fertilizers, residues and sediments carried by runoff; in addition, in a coastal strip of up to 10 km, saltwater intrusion into coastal aquifers can threaten the potability of their waters.
- Individuals living or working on flooded land can suffer heavy economic consequences, exacerbating poverty and access to water and sanitation services.
- Recurring floods can cause communities to abandon safe sanitation and hygiene practices and return to defecating in the open.
- Floods can put large numbers of people into refugee camps or temporary accommodation. This type of accommodation is less likely to be culturally acceptable, or to provide for marginalized populations such as women and girls with menstrual needs, LGBTQ people, children, the elderly and people with disabilities.
- Floods can collapse sewage systems and produce "black floods" inside houses through toilets.

Deglaciation



Glacial and snow masses around the world are predicted to reduce significantly, over the course of the 21st century. The seasonality of the river flows will change. Spring melt floods will become smaller, and without regulation of these snow masses and glaciers, runoff will depend on rain, rather than snow.

Impacts on the human rights to safe drinking water and sanitation

- Melting of glacier ice and snow will have consequences for inhabitants of mountainous basins, who will have to adapt water storage to account for changing seasonal patterns and reduced natural storage and flow regulation capacities.
- The sustenance glacier melting throughout the year, rather than with a peak in the summer, may reduce on the summer water flows in the downstream parts of glacier basins.
- Storage alternatives may be unaffordable, or culturally unacceptable in regions where populations rely mostly on the usual river regime.



Temperature rise

As the primary vector of climate change, temperature rising is a major driver in all climate-related impacts on water and sanitation. Higher temperatures lead to higher evaporation from water bodies, higher evapotranspiration from vegetation, and greater water needs, both for drinking water supplies and especially for irrigation. This has consequences: lower flows in rivers and less infiltration into aquifers, as well as increasing urban and irrigation demands. Additionally, higher temperatures associated with climate change can degrade vegetation cover and increase the risks of forest fires and consequent increased soil erosion. All this implies an increase in runoff when there is heavy rains, which accelerates the processes of erosion and clogging of the reservoirs by sediments, in addition to less infiltration into the aquifers and, ultimately, a lower water storage capacity.

Impacts on the human rights to safe drinking water and sanitation

- The serious loss in the capacity for storage and flow regulation in river headwaters due to the melting of glacial masses, is coupled with the already explained reduction of river flows, due to increased evapotranspiration and the lesser storage of water in the aquifers and reservoirs, due to less infiltration and accelerated soil erosion and clogging of reservoirs. This may cause an aggravation of water stress problems, with consequences on the availability of drinking water, rising water tariffs and problems of drinking water affordability, especially for the most impoverished
- Rising temperatures may have important impacts on the quality of drinking water: for every 1° C increase in temperature there is an 8% rise in E. coli-related diarrhea.
- Eutrophication of water bodies and the appearance of cyanobacteria that produce toxic contamination reducing the potability of water are aggravated.

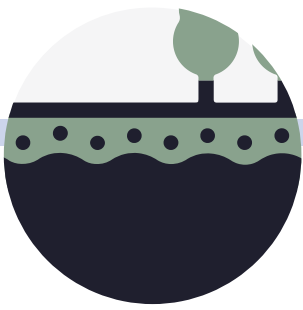
Sea-level rise



Sea-level rise predicted because of climate change will threaten access to water and sanitation on low-lying coastal areas for two main reasons. First, it will increase the vulnerability of infrastructure in low-lying coastal areas to flooding. Compounded with higher sea levels and more intense storms, storm surges may reach further inland at faster speeds. In addition, rising sea levels could cause the intrusion of saltwater into the coastal aquifers.

Impacts on the human rights to safe drinking water and sanitation

- Increased flooding can threaten water quality due to the contamination of water sources, and the overwhelming of sanitation infrastructure.
- The accessibility and safety of water and sanitation services can be threatened where flooding and heavy storms become frequent.
- The salinization of groundwater reduces the quality of drinking water and can have important health implications.



Groundwater storage

An important key to tackling climate change to ensure safe drinking water and sanitation lies in the great inertia and relative stability of groundwater, stored in aquifers. Aquifers are nature's water lungs, storing and protecting huge quantities of water underground, under fairly and more stable conditions than surface water bodies. Depending on how they are managed, the water levels and quality of aquifers can and should be as strategic drinking water reservoirs for managing future droughts.

Impacts on the human rights to safe drinking water and sanitation

- Over-pumping can deplete the aquifers breaking their vital function as strategic reserves for droughts, and can lead to declines in water quality through by increasing the concentration of pollutants and/or favouring saline intrusions in coastal aquifers.
- The exploitation of deeper groundwater sources also has implications for affordability of water and sanitation services, as pumping costs can increase tariffs making them unaffordable for the most impoverished.



The exploitation of deeper groundwater may be a short-term alternative but it has no prospects for sustainability and may have implications for the affordability of water and sanitation services, especially if water markets are in place, enabling speculative businesses based on people's most basic need, including their human rights to safe drinking water and sanitation.

Wetlands, riparian ecosystems and vegetation cover



Strengthening the resilience of aquatic ecosystems is one of the keys to climate change adaptation strategies, and to this end it is essential to recover and conserve, not only of aquifers, but also of the most inertial surface water ecosystems: wetlands and riparian river ecosystems. Wetlands are surface water reserves, which regulate river flows. They expand river floods and soften their destructive energy, while, on the coasts, mangroves protect coastlines from major storms. They are natural macro-purifiers that regenerate water quality, prevent eutrophication processes and sustain a large part of the biodiversity on continents and coasts. On the other hand, we must be aware of the importance and functions of riverside ecosystems and riparian forests, as part of river channels. Even the vegetation cover of islands and continents is key in protecting the water cycle from the impacts of climate change, since they prevent soil erosion and favour infiltration into aquifers.

Impacts on the human rights to safe drinking water and sanitation

- Ecosystem collapse will lead to widespread declines in water quality. The destruction or degradation of vegetation cover facilitates soil erosion, thus increasing the sediment load of water, accelerating the clogging of reservoirs and reducing infiltration and recharge of aquifers.
- Restoring and maintaining the good condition of aquatic ecosystems and vegetation cover increases drought buffers and regenerates water quality, while smoothing floods, in the most effective and economical way. Ultimately, it reduces risks to the population, especially the most vulnerable and impoverished, while protecting their human rights.



Impacts of climate change on the human rights to water and sanitation by region

Sub-regional areas with specific vulnerabilities

Access to drinking water and sanitation will be more impacted by climate change in certain areas than in others. The geographical characteristics of those areas lend them specific vulnerabilities to climate change, and populations living in those areas face larger threats to the enjoyment of human rights to safe drinking water and sanitation, and as such, must be prioritized in adapting to climate change.

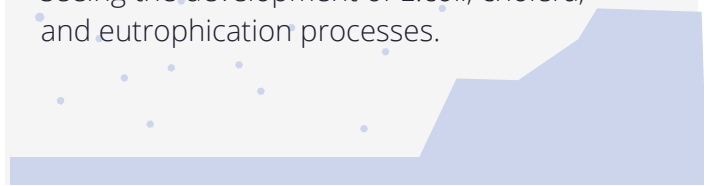
Small islands

Projected increases in sea-level combine with predictions of extreme events, including storm surges and El Niño- Southern Oscillation, put the low-lying land of small islands at risk of flooding. This can lead to the destruction of supply and treatment infrastructure, and to water contamination. It is also likely to increase saltwater intrusion into groundwater.



Polar regions

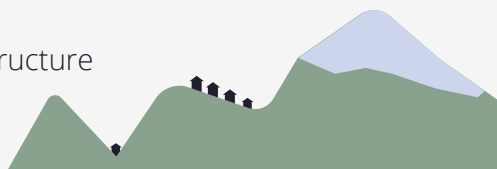
As permafrost thaws, pipes, roads, and storage and treatment facilities in the Arctic will be likely to shift and become damaged, with rising maintenance costs that could impact the affordability of services. Water quality is also predicted to decrease with rising temperatures, seeing the development of E.coli, cholera, and eutrophication processes.



Mountainous areas

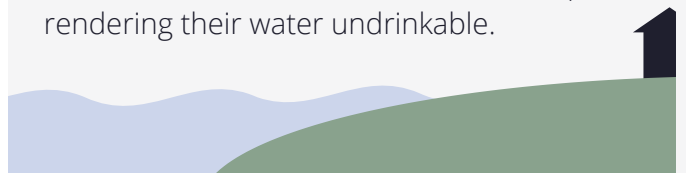
Mountain glaciers and snowcaps show a melting trend almost everywhere in the world.

Mountainous areas will see changing seasonality of water flow, as glaciers begin to melt steadily throughout the year, and precipitation increasingly falls as water rather than snow. This is likely to reduce droughts, but increase risks of floods, especially flash floods, putting local infrastructure at risk.



Coastal areas

More than 600 million people (around 10% of the world's population) live in coastal areas that are less than ten meters above sea level. Coastal areas are vulnerable from the increase in sea levels, and flooding due to storm surges. This will have severe impacts on water supply and sanitation infrastructure. Sea-level rise can also lead to the salinization of coastal aquifers, rendering their water undrinkable.



Main trends by region

The regions were selected in accordance with those used to describe regional impacts of climate change by the Intergovernmental Panel on Climate Change (IPCC).

Africa



Between 2000 and 2020, the population with access to drinking water went from 67.91% to 78.69% in North Africa and from 17% to 30% in sub-Saharan region. The population with access to sanitation grew from 24.79% to 41.73% in North Africa and from 14.3% to 21% in Sub-Saharan Africa.



Changing patterns of precipitation

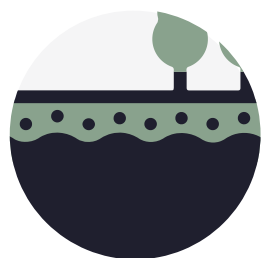
Climate change is expected to change patterns of precipitation, concentrating it during heavy rainfall events. While total precipitation is expected to reduce in some regions of Africa such as southern Africa, the heaviness of rainfall is expected to increase across the continent. Heavier rainfalls will lead to a significant increase in the risk of flooding, which can disrupt the availability of water by damaging infrastructure, and can contaminate both groundwater and surface supplies. This can threaten drinking water quality, threaten affordability, and extreme cases, the availability of water of local populations. In areas such as the Sahel, torrential rains and long droughts accelerate mass migration processes.



Droughts

Climate models predict longer and more frequent droughts across the continent, as periods between rainfall become longer. Therefore, shortages of water, and particularly potable water are expected to increase during long periods of drought, as the continued availability of potable water and sanitation services is not guaranteed.

Without proper governance and planning for these droughts, the availability of drinking water and sanitation services will not be continuous. Parts of Africa, including most southern Africa, are predicted to see a long-term decline in rainfall and water flows. In areas such as the Sahel, increasingly long and intense droughts are accelerating processes of desertification, threatening the lives of nomadic communities and even the habitability of vast territories, which augurs massive migratory processes.



Groundwater storage

Africa has significant groundwater stores, the importance of which grows with climate change. Although in most of these aquifers no strong impacts on recharge due to climate change are expected, particularly drought-sensitive territories such as the Sahel, the Horn of Africa and southern Africa may experience a decrease in groundwater recharge, especially in shallow aquifers. In addition, as exploitation of these aquifers increases, due to hardening droughts and population growth, their sustainability may be put at risk and the quality of water may be degraded by overexploitation, contamination and intrusion of saltwater in coastal aquifers.



Asia

In central and southern Asia, access to safely managed drinking water grew from 46.06 % in 2000 to 62.36% in 2020. In the same period in eastern and south-eastern Asia, access to basic drinking services grew from 80 to 94%. Asia has seen large improvements in access to sanitation: between 2000 and 2020, access to safely managed sanitation services grew from 12.2% to 46.57% in central and southern Asia, and from 20.73% of the population to 60.22% in eastern and south-eastern Asia.

Droughts



Drinking water scarcity will be one of the major challenges for the Asia region, as a consequence of the combined effects of droughts and increased rainfall variability due to climate change, poor water management, massive contamination, aquatic ecosystems degradation and rapidly growing water demands. Alongside this growth in demand, the ability and quality of water supplies is expected to become increasingly uncertain.

Deglaciation



the impact of droughts will be intensified by progressive deglaciation. About 1.3 billion people in South Asia rely on freshwater obtained directly or indirectly from the Hindu Kush mountains, which feed 10 river basin whose flows are regulated by the masses of ice and snow from the mountains. Climate models predict a significant acceleration of glacier melt in the first half of the 21st century, and a drop-off in water flow afterward. The impact of this decrease will be felt mostly within the populations living in the mountains, who rely almost exclusively on water that regulates glaciers, and of those living downstream, particularly in arid lowlands surrounding the Himalayas.

Groundwater storage



Increased water stress is also predicted to put pressure on Asia's groundwater resources. Groundwater use in the region could increase by 30 per cent by 2050. The increase in demand for irrigation has already led to overexploitation and severe groundwater stress in the north China Plain and northwest India.

Overexploitation of groundwater can lead also to a reduction in water quality, and in moments of drought, interruption in the continuity of services. The OECD found that 79 per cent of countries in the Asia-Pacific region had no policy instrument to monitor or allocate groundwater.

Floods



Increased heavy rains and particularly monsoons, coupled with less regulation of melting glacial masses, are expected to increase flood risks, in most of the region, and in particular East, South, and South-East Asia. Such flooding can destroy drinking water points and sanitation facilities, damage delivery and treatment infrastructure, and contaminate water sources. Increased flood risks are exacerbated in the low-lying coastal areas of the region, including Bangladesh, parts of the Malayan peninsula, and the Mekong delta, where storm surges and sea-level rise create flooding of saltwater.

South and Central America



Between 2000 and 2020, access to safely managed drinking water grew little, from 70.1% to 75.34% of the population and the access to safely managed sanitation services from 15.18% to 34.07%. These figures highlight the vulnerability of a high proportion of the population in a general context of increasing pollution of rivers and aquifers, deforestation and growing risks of droughts and floods due to climate change.



Droughts

Despite sub-regional variations, the region is expected to face widespread water stress. The IPCC predicts that water supply shortages will increase in already vulnerable semi-arid regions, with reduced precipitation and increased evapotranspiration due to higher temperatures. Increasing dryness is expected in countries in Central America, with greater uncertainty in the south of the subregion. Rainfall is expected to decrease in the Caribbean, with severe impacts on the availability of drinking water, as water sources dry up during periods of low precipitation.



Deglaciation

Glaciers in the Chilean and Argentine Andes have been retreating during the last decades. Glacial melting has important consequences for drinking water and sanitation, particularly in mountain regions, where the seasonality of water flow can be disrupted, meaning that the availability during certain months of the year can be limited. In the medium and long term, the disappearance of flow regulation generated by glaciers will make flows more irregular and floods more likely when there is intense rainfall that will tend to be rain rather than snow.

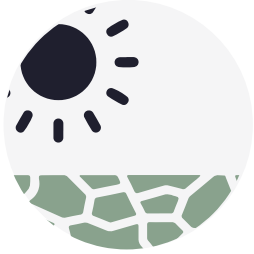


Floods

In addition to drought, the region faces a high vulnerability to flooding. Central America, for example, has been identified as one of the most responsive regions to climate change, seeing a steady increase in extreme events such as storms and floods. The toxic diffuse contamination affecting drinking water by pesticides increases with the intense rains when "washing" phenomena of contaminated land take place. On the other hand, the growth of toxic open-pit mining is multiplying massive deposits of toxic tailings without surveillance or maintenance, which increases the risks of overflows and collapse of these infrastructures.

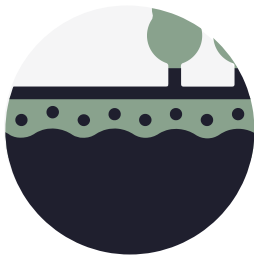
Europe

Access to safely managed drinking water in Europe is high, growing from 86.98% to 91.33% of the population between 2000 and 2020. Access to safely managed sanitation is also high, growing from 61.6% to 70% to the same period.



Droughts

Projections suggest that there will be an increase in the frequency and severity of droughts, especially in the Mediterranean area, due to reduced river flow. In areas such as south-eastern Spain, overexploitation of rivers and aquifers alarmingly increase vulnerability to future droughts. Future water quality is expected to decrease as a result of reduced flows and the consequent reduction in the dilution capacity of rivers.



Groundwater storage

Groundwater quality is predicted to be threatened by climate change and increasing use pressure. Overexploitation of aquifers, due to irrigation demands and tourism growth, especially in southern Europe, increases the vulnerability of sensitive areas to drought risks, which climate change tends to aggravate. In the medium and long term, the progressive salinisation of coastal aquifers, due to rising sea levels, threatens the potability of water in highly populated areas.



Floods

Climate models suggest that Europe will see a drastic increase in the frequency and intensity of floods, triggered by intense precipitation events, especially in Mediterranean regions. Even where average river flows will be significantly reduced, as in the Iberian Peninsula, the expected increase in rainfall variability will increase flood risks and their consequences on water and sanitation services.

Australasia

Access to basic drinking water services in Australia has been over 99% since 2000. Access to safely managed sanitation grew from 60% to 75.5% between 2000 and 2020.



Changing patterns of precipitation

Projections for average annual runoff in far south-eastern Australia range from little change to a 40 per cent decline for 2°C global warming above current levels. Freshwater resources are projected to decline in southwest and southeast Australia, as well as in New Zealand. Stress on water resources in the southern Australia, driven by rising temperatures, with associated increases in plant evapotranspiration, and reduced cool-season rainfall are already being felt, as in the Murray Darling Basin, previously subject to over-exploitation of available flows and over-allocation of use rights.



Floods

Rising sea levels and increasing heavy rainfall are projected to increase erosion and flooding, with consequent damages to many low-lying populations through damage to infrastructure and water contamination, particularly in northern Australia and southern New Zealand.

North America

Access to safely managed water services in America grew from 95.27% in 2005 to 97% in 2020, and access to safely managed sanitation grew from 75.65% to 81% in the same period.



Floods

A significant impact of climate change on North America will be the increase in frequency, intensity, and consequences of floods. The frequency of floods caused by extreme weather events, in particular, is predicted to increase steadily. These floods are projected to decrease drinking water quality by damaging and saturating urban drainage throughout most of North America. Extreme events have already caused significant damage to infrastructure. As an example, Hurricane Katrina caused loss of power and pressure, and damage or destruction to treatment plants and water distribution systems across New Orleans, leaving over 100,000 people without drinking water, or exposed to E.coli and cholera. The disproportionate number of victims in impoverished African-American neighbourhoods was also evident. Beyond emergency measures, recovery took a long time - many neighborhoods went without drinking water for more than a year due to unprecedented damage.



Droughts

Observed climate trends in North America include longer and more frequent droughts and an increased occurrence of severe hot weather events with extreme heat waves that trigger unprecedented wildfires, such as in California, exacerbating erosion processes, accelerating the clogging of reservoirs and reducing infiltration to aquifers. Overexploitation of surface flows and especially of underground aquifers in sensitive regions of North America, such as the southwestern USA, northern and central Mexico (particularly Mexico City), southern Ontario, and the southern Canadian Prairies are multiplying the vulnerability of these territories to future droughts. As a consequence of overexploitation also, toxic pollutants are emerging, such as arsenic, which is naturally present at the bottom of certain aquifers, affecting more and more populations. The existence of water markets and even the fact that water rights are listed on futures markets, as is the case in California, under speculative strategies, can drive urban drinking water rates unaffordable for populations living in poverty or situations of vulnerability.

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