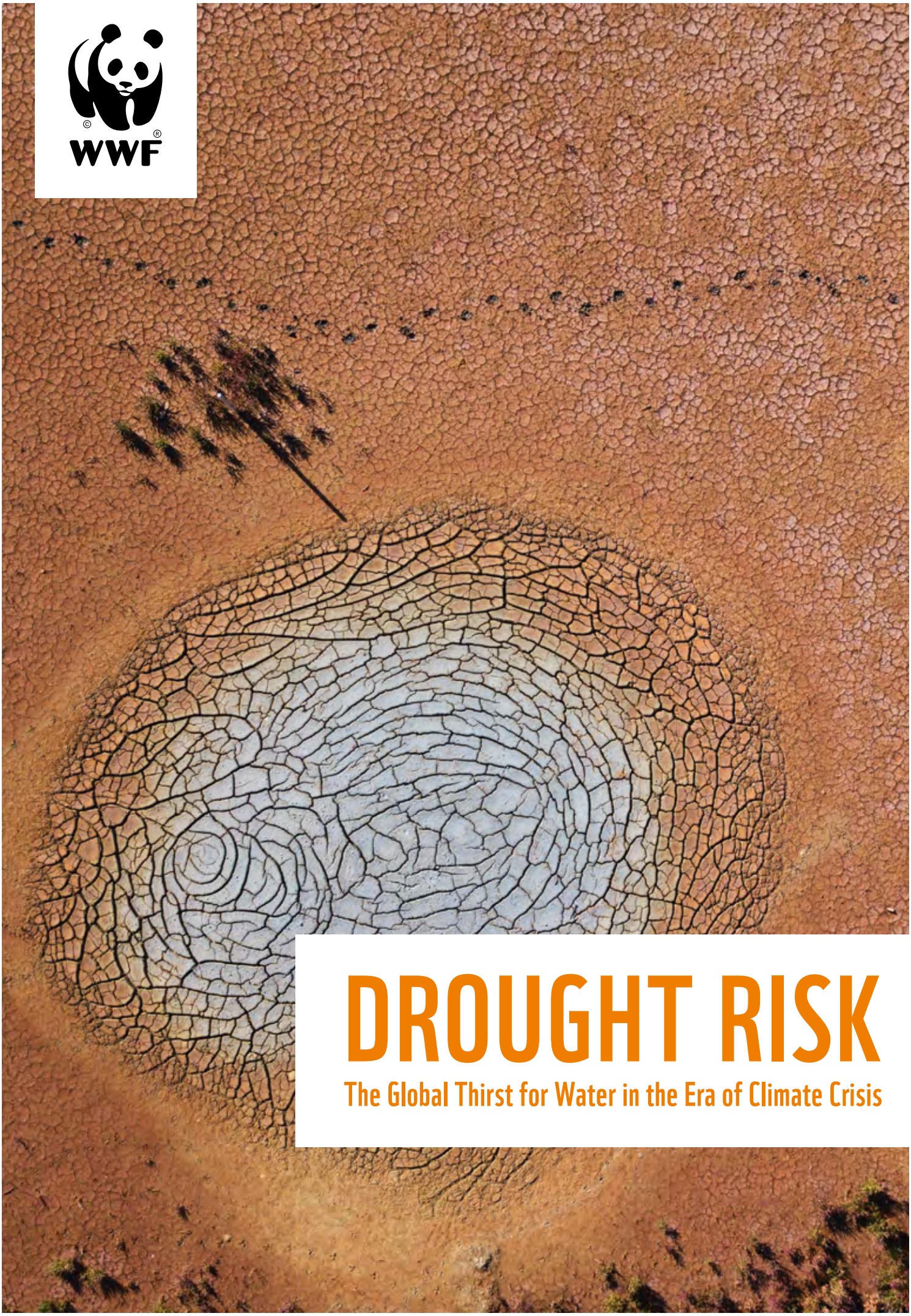

DROUGHT RISK

The Global Thirst for Water in the Era of Climate Crisis

IMPRINT

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Broken bottom of a dried-up lake. Province of Santa Cruz, Patagonia, Argentina.

SUMMARY

AN AVERAGE OF 55 MILLION PEOPLE AROUND THE WORLD ARE AFFECTED BY DROUGHTS EVERY YEAR.

Droughts are among the most devastating natural disasters on earth. Already today, an average of 55 million people around the world are affected by droughts every year. The direct and indirect impacts of these droughts are increasingly challenging as they permeate all areas of our lives: local water supply systems, the natural environment*, agricultural production, infrastructure, energy supply and the local economy.

Based on existing studies and the WWF Water Risk Filter (WRF), this study assesses the drought risk for cities, areas where maize, rice and wheat are grown, wetlands, power plant sites and regions with a potential for water-related interactions.

According to this study, 19 per cent of large cities with over one million inhabitants are already situated in areas with a high to very high risk of drought, which means: roughly 370 million people worldwide live in drought risk areas.

The sector most affected by droughts and water scarcity is agriculture. Important sources of food such as wheat, maize and rice are exposed to a high risk of drought throughout the world. For example, 22 per cent of global wheat production (123.7 million tonnes) comes from areas with a high to very high risk of drought.

The effects of droughts can mainly be seen in the diminished availability of water in rivers, lakes and wetlands. Around one sixth of all wetlands designated as in need of strict protection internationally by the Ramsar Convention** are exposed to a high risk of drought. But our energy supply is also affected: Half of the world's thermal power is produced in areas with a high risk of drought. The massive increase in energy demand in the Global South will exacerbate the situation even further.

* Natural environment: the characteristic occurrence of a species in a given geographical and climatic region.

** As early as 1971, an international treaty was adopted in the Iranian city of Ramsar to confer a special status on wetlands and promote nature conservation.

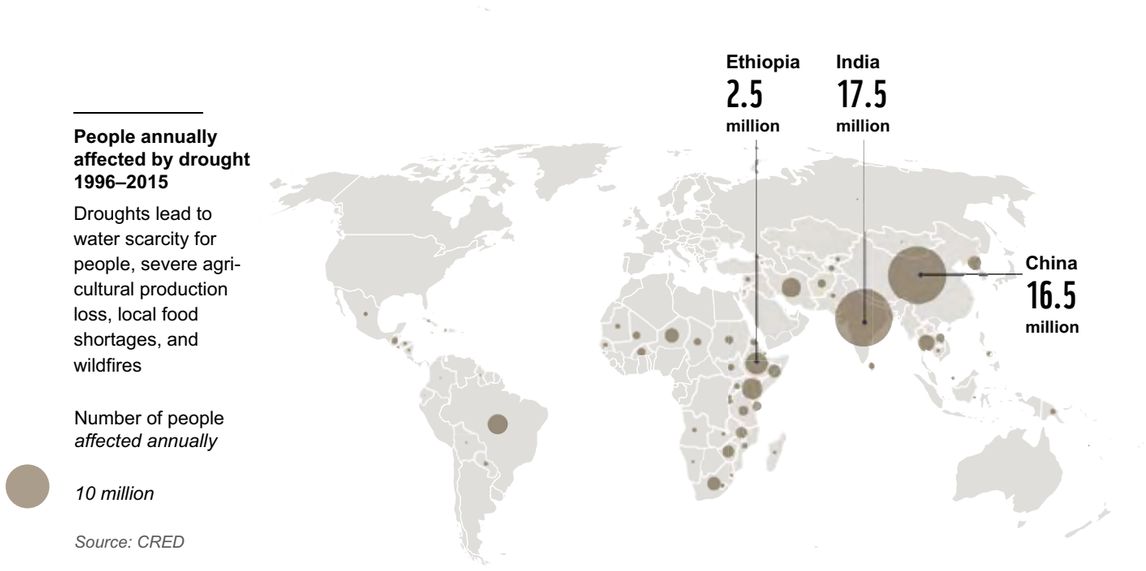


Figure 1: People annually affected by drought (data source: PBL Netherlands Environmental Assessment Agency, 2018: p.16)

In addition to these aspects, droughts also cause socio-political problems such as regional conflicts and migration. Although conflicts over freshwater resources are usually not the sole trigger of armed conflicts, they can exacerbate existing tensions, regional instability and social unrest. 38 per cent of the areas in which the probability of water-related political disputes is high are also exposed to an increased risk of drought. However, it becomes particularly alarming when several factors occur simultaneously. There are regions, such as the Middle East, North Africa or the Mediterranean, where droughts simultaneously threaten the urban water infrastructure, food security, ecosystems and energy supply, thereby increasing the potential for conflict on the ground.

Even though industrialised countries in central and northern Europe still have comparatively sufficient water resources, they are also affected by a risk of drought, as is the case in Germany. As the drought years 2018/2019 showed with crop losses, low water levels, forest fires, water rationing for households as well as a limited supply of electricity and raw materials, we are far from ready to meet these challenges.

Water pump at Barefoot College in Tilonia, Rajasthan, India.

AND THE CLOCK IS TICKING!

In view of the fast pace of global warming and the associated extreme weather events, we urgently need to implement more ambitious climate targets and measures at all levels:

1. The international community must significantly increase its climate contributions (at least 65 per cent emission reduction by 2030 compared to 1990) and underpin the targets of the Paris Climate Agreement with effective measures to limit global warming to 1.5 degrees Celsius.

2. Freshwater protection must be regarded as a priority for climate change adaptation within development cooperation, particularly in the context of the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMUB) and the funding instruments of the German Federal Ministry of Economic Cooperation and Development (BMZ) or the EU.

3. Binding social, human rights and environmental standards must be integrated into EU trade, investment and economic treaties. A due diligence law, including mandatory environmental criteria, particularly for water-intensive industries, must be adopted and implemented.

4. Companies must ensure complete supply chain transparency, use systematic analyses to identify water risk areas and implement measures on the ground together with relevant stakeholders.

5. The protection of freshwater must be elevated to the level of a priority issue in setting the framework for sustainable financing, e. g. in the EU Sustainable Finance Action Plan and the Task Force on Climate-related Financial Disclosure (TCFD).

6. We can all make a difference, for example, by eating a regional, seasonal and low meat diet, using consumer goods like textiles or electronic equipment for longer periods of time, and repairing and recycling them.

THIS CAN ONLY SUCCEED IF OUR ACTIVITIES TAKE INTO ACCOUNT SOCIAL, ENVIRONMENTAL AND ECONOMIC ASPECTS – AND WE COMMIT TO SUSTAINABLE WATER USE AS THE WORLD'S POPULATION CONTINUES TO GROW!

Cattle carcasses in Djoudj National Park, Senegal

DROUGHTS: THE GLOBAL THIRST FOR WATER

" CLIMATE CHANGE WERE A SHARK, WATER WOULD BE ITS TEETH."

—— H.E. Mr János Áder, President of Hungary at the World Water Week in Stockholm, 2017

Around 90 per cent of natural disasters are caused by water and they will increase in frequency and intensity in the future.[1] Droughts are natural phenomena originating from the climate. They occur when rainfall is lower than average in a certain region over a certain period of time. Droughts are among the most devastating extreme weather disasters in the world due to their long-term socio-economic and environmental impacts. They result in water shortages, so that the needs of humans and the natural environment can no longer be met.

Freshwater is not only an important nutrient, but also essential for the production of food, energy and almost all industrial products. The impact of droughts can be direct, including water scarcity, crop losses, local food shortages and forest fires, or indirect, such as migration, unemployment and social unrest. Already today an average of 55 million people worldwide are affected by droughts every year.[2]

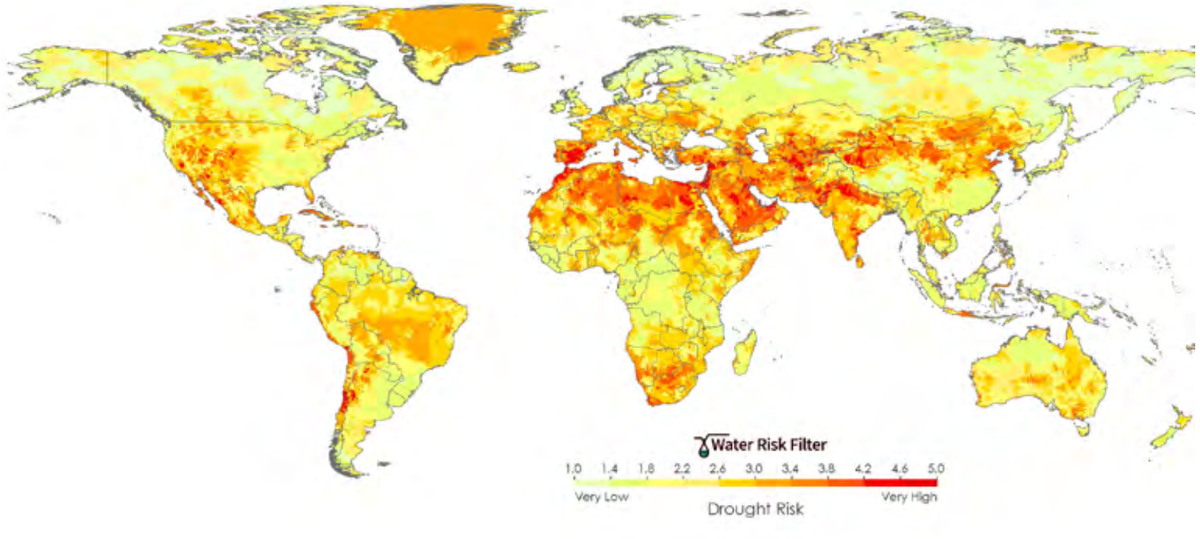


Figure 2: Global drought risk (data source: WWF 2018)

In view of the increasing global demand for water – global water withdrawal is expected to increase by 55 per cent by 2050[3]* – droughts increase the pressure on our natural freshwater resources, thus exacerbating water scarcity caused by humans.

Based on external data sources and the WWF Water Risk Filter (WRF), this study aims to assess the drought risk for cities, areas where maize, rice and wheat are grown, wetlands, power plant sites and regions with water-related political conflict. The drought risk comprises several indicators of physical risk: water depletion, baseline water stress, projected change in water discharge, estimated occurrence of droughts and the projected change in the occurrence of droughts. The drought risk is based on a scale of one to five, one being very low risk and five very high risk.**

Box 1: The Water Risk Filter

The WWF Water Risk Filter is a leading online tool which enables companies and financial institutions to assess and respond to water risks in their operations, supply chain and investments. More than 200,000 sites have already been assessed by over 4,000 users from various industries.

Since it was first launched in 2012, the WRF has been the only tool that provides a comprehensive risk assessment based on a company's geographical location and industry classification.

Following an extensive upgrade in 2018, the WRF now has a new module for identifying risk mitigation measures. This enables companies and financial institutions to explore, assess and respond to their water risks. The WRF will soon be expanded to cover two other important functions: an instrument that enables water risks to be expressed in monetary terms and incorporates climate change scenarios.

More information can be found at:
waterriskfilter.panda.org

* Mainly due to the increasing demand in production (400 per cent), thermal power supply (140 per cent) and household consumption (130 per cent).
** See Annex for a more detailed breakdown of weightings and data sources.

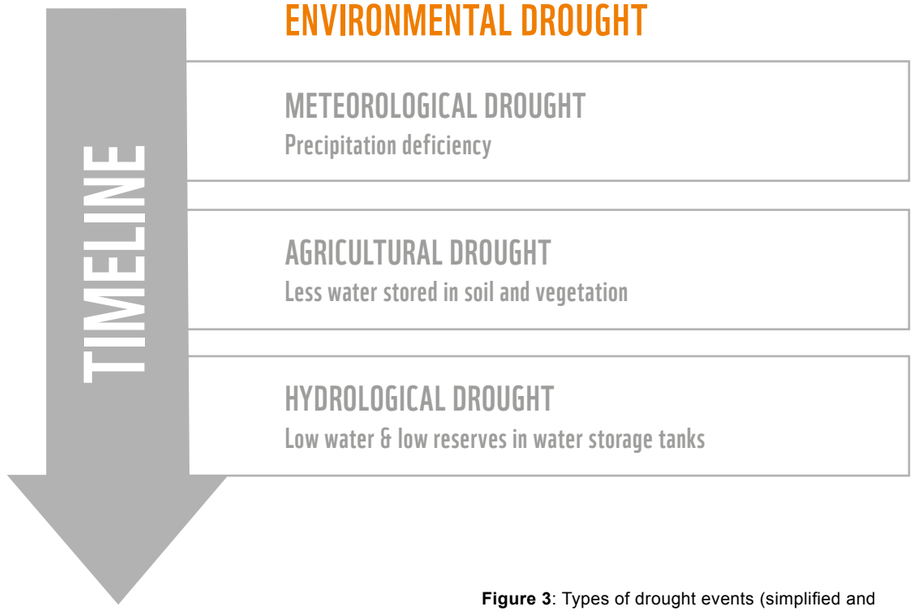


Figure 3: Types of drought events (simplified and adapted diagram according to NDMC)

Box 2: What is a drought?

Droughts are defined as a period of unusually dry weather that lasts long enough to cause a shortage in a region's water supply.[4] A distinction is made between meteorological, agricultural and hydrological droughts.[5]

- **Meteorological drought:** variability from average precipitation values over a significant period of time in a river basin or region.
- **Agricultural drought:** unusual and significant soil or vegetation water deficiencies.
- **Hydrological drought:** unusual and significant groundwater deficiency, low water levels in rivers and lakes.

Every drought starts as a meteorological drought. Depending on the composition of the soil and the water needed for the farmed crop, this can lead to an agricultural drought. The occurrence of a hydrological drought depends on precipitation, evapotranspiration* and use of land and water by human beings. A hydrological drought does not occur when the drought period is relatively short. The combination of below-average rainfall, reduced water run-off, and a low groundwater level is also known as an environmental drought.

* Describes the sum of evaporation and transpiration, i.e. the evaporation of water from flora and fauna as well as soil and water surfaces.

Between 2015 and 2018, Cape Town struggled with one of the worst droughts in 100 years.

DROUGHTS & CITIES

Cities are hard-hit by global warming and thus also by extreme weather events. As hubs for business, transport and households, they have a particularly high local need for water, especially drinking water, and they compete with other users from the agricultural sector and the chemical, textile and raw materials industries for access to water.

A decline in groundwater resources or insufficient water levels in reservoirs have dramatic effects on the local drinking water supply. Drinking water for households is sometimes rationed and can even lead to a total collapse in supply, especially where the public infrastructure can no longer keep pace with population growth. Due to the higher population density in urban areas, water shortages can result in inadequate basic sanitation, expedite the outbreak of disease[6] and, in extreme cases, lead to social unrest and migration.

WWF's research shows: already 19 per cent of cities (with more than one million inhabitants) are located in areas with a high to very high risk of drought; this means that around 370 million people around the world are affected. These cities include six megacities (>10 million inhabitants): Delhi, Cairo, Karachi, Istanbul, Rio de Janeiro and Hyderabad. It is not only cities in developing or emerging countries that are severely affected by droughts, but also cities in industrialised nations. In addition to Istanbul, the cities with the highest risk of drought in Europe include Madrid, Lisbon and Amsterdam.

73 PER CENT OF CITIES CONSIDER THEIR WATER SUPPLY TO BE AT INCREASED RISK DUE TO GLOBAL WARMING.

According to a CDP study* 73 per cent of cities consider their water supply to be at increased risk due to global warming, with 83 per cent (196 cities) rating water scarcity as a serious problem.[7]

At present, around 55 per cent of the global population lives in urban areas. This figure is expected to rise to 70 per cent by 2050, with 90 per cent of this increase primarily in Asia and Africa.[8] Even given an optimistic climate scenario, 77 per cent of the largest cities will experience a significant change in climate conditions by 2050. According to a study by the Swiss Federal Institute of Technology in Zurich (ETH Zürich), the climate in cities tends to change into a subtropical climate. Climate conditions that exist today more than a thousand kilometres further south will prevail in large cities in the northern hemisphere in the future.[9]

* The Carbon Disclosure Project (CDP) is a non-profit organisation founded in London in 2000 with the aim of encouraging companies and municipalities to publicly disclose their environmental data. The study cited here analysed 2017 data from 569 cities and 2016 data from 1,432 companies on urban water problems.

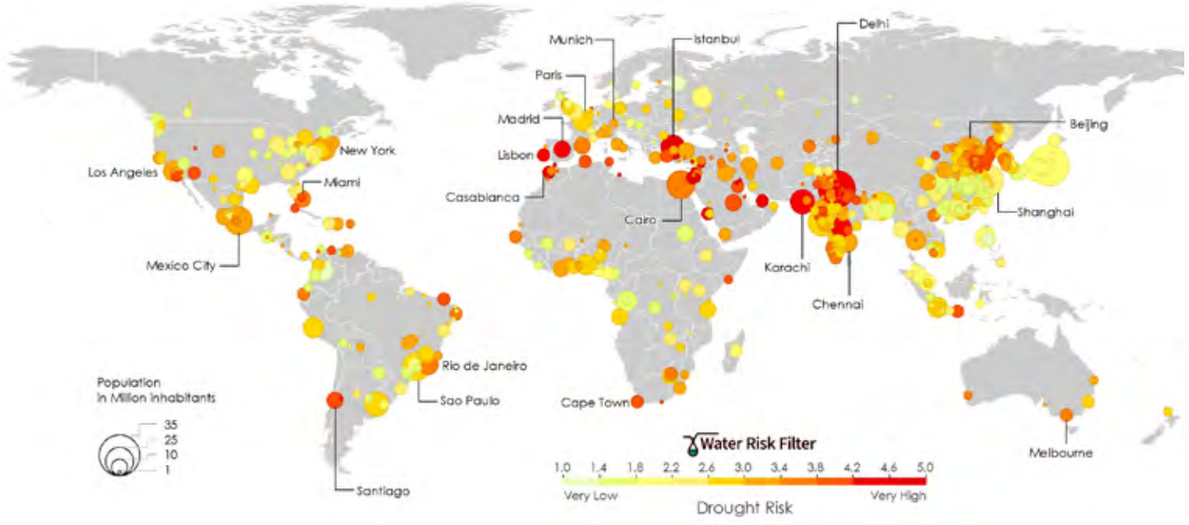


Figure 4: Drought risk for cities (data source: WWF 2018 and McDonald & Shemie 2014)

Box 3: Drought in Cape Town

South Africa's second-largest city struggled with one of the worst droughts in 100 years between 2015 and 2018. It was declared a national disaster by the government. The water crisis peaked during mid-2017 to mid-2018 when water levels hovered between 15 and 30 per cent of the actual dam capacity. Strict water rationing for private households and agriculture was the only way to delay "Day Zero", the name given to the day when the taps would be switched off in the metropolis with its several million inhabitants. To this end, it was necessary to reduce daily water consumption per inhabitant by more than half. 50 litres of freshwater per person[10] had to suffice for drinking, showering, cleaning, washing clothes, cooking, etc.

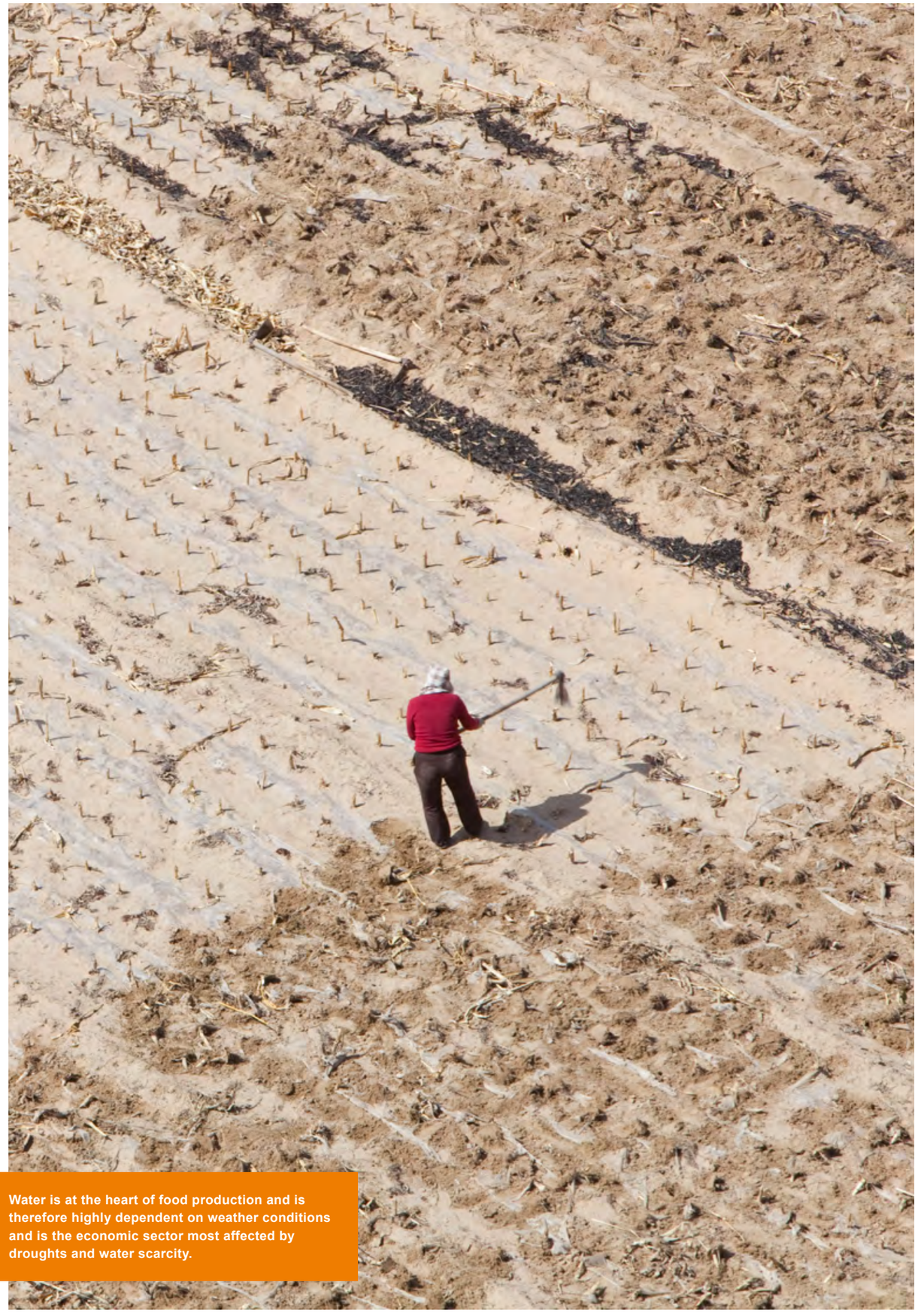
In comparison: consumption is more than 120 litres per person per day in Germany, almost 300 litres per day in the USA. The water crisis also had far-reaching effects beyond Cape Town's city limits. As a result of water rationing, agriculture in the Western Cape was forced to reduce its water consumption by an average of 60 per cent. Among other things, this led to a 20 per cent decline in the fruit harvest and an estimated economic loss of USD 400 million. Exports from the region fell by 13–20 per cent. 37,000 jobs were lost in the Western Cape province, which also caused an estimated 50,000 people to slip below the poverty line.[11]

In India, temperatures rose up to 50 degrees Celsius. The severe drought has dried up many rivers, mainly because there was too little rain during the monsoon season.

Box 4: Chennai in crisis[12]

Since June 2019, eleven million people in India's sixth largest city have not had enough water due to the overdue monsoon season. The Central Water Commission reported a precipitation deficit of 41 per cent for the state of Tamil Nadu and "Day Zero" was declared on 19 June. The four large water reservoirs, which normally supply the city with drinking water, were as good as dried up. Together, they still held three million cubic meters of water, which corresponds to only 0.95 per cent of the total possible capacity of 313 million cubic meters. The drinking water supply of the city was cut in half and the price for private water supply quadrupled within a few weeks. A water tank with approx. 12,000 litres would have cost 1,500 rupees (approx. USD 22) in April. In the month of July, a water tank with the same amount of water cost USD 85.[13]

Hundreds of thousands of households, hospitals and other public institutions are directly affected by this water shortage.



Water is at the heart of food production and is therefore highly dependent on weather conditions and is the economic sector most affected by droughts and water scarcity.

DROUGHTS & FOOD SECURITY

Water is at the heart of food production. Large quantities are used to produce everything we eat and drink. Agriculture is by far the largest consumer of our freshwater resources using 70 per cent. And: the pressure on freshwater resources continues to increase due to the growing global demand for food. In order to feed more than 9 billion people, food production must increase by 50 per cent by 2050.[14]

Grain remains the most important source of calories for the majority of the world's population. In particular, the annual demand for maize, wheat and rice is expected to reach 3.3 billion tonnes by 2050, which is 800 million tonnes more than the record harvest of 2014.[15] However, farming these three grains is particularly water-intensive (it accounts for the largest share of the global water footprint[16]) and is therefore particularly susceptible to drought.

The results of the present study show:

- 2 per cent of global wheat production (around 124 million tonnes) already comes from areas with a high to very high risk of drought
- 15.4 per cent (88 million tonnes) for rice
- 8.4 per cent (50 million tonnes) for maize

MORE THAN 80 PER CENT OF THE DAMAGE AND LOSSES CAUSED BY DROUGHTS ARE INCURRED BY AGRICULTURE.

Agriculture is highly dependent on weather conditions and is the economic sector most affected by droughts and water scarcity. More than 80 per cent of the damage and losses caused by droughts are incurred by agriculture. In sub-Saharan Africa, droughts between 1991 and 2013 led to production losses of around USD 31 billion, with the highest losses – USD 19 billion – reported in East Africa.[17]

Losses in food production are directly linked to an increase in the prices of raw materials. This was evident, for example, in coffee prices between 2014 and 2018. Droughts in Brazil and Vietnam pushed prices up as much as 50 per cent.[18] Especially in countries where agriculture is an important industrial sector, droughts have a negative impact on the national gross domestic product (GDP).

The pressure on freshwater resources continues to increase due to the growing global demand for food.

One example: in sub-Saharan Africa, more than 60 per cent of the population lives from agriculture and contributes an average of 25 per cent to GDP.[19]* If the prices of raw materials rise, livelihoods at local level can deteriorate due to limited access to high-quality food; and farmers affected by droughts can suffer income losses or even unemployment.

Box 5: Kenya's food crisis[20]

In 2017, Kenya's government declared a national emergency due to drought. The number of people in need of humanitarian aid doubled from 1.3 million to 2.6 million in just six months. In half of Kenya's 47 districts, water sources dried up, leaving an estimated 3 million people without access to clean water. Crop yields were as much as 70 per cent below the five-year average, causing food prices to skyrocket.

Maize prices rose by 20 to 30 per cent compared to the previous year. Milk and meat production also fell drastically due to the loss of 40 per cent of livestock. It is estimated that nearly 500,000 children were affected by the drought. With increasing malnutrition, the risk of infectious diseases and diarrhoea increased, especially among children. USD 43.2 million was needed to ensure the supply of staple foods to treat acute malnutrition. A total of USD 165.71 million in aid was needed.

* Analysis of damage and losses in the agricultural sector caused by 78 natural disasters between 2003 and 2013 in developing countries in Africa, Asia and the Pacific as well as Latin America and the Caribbean.

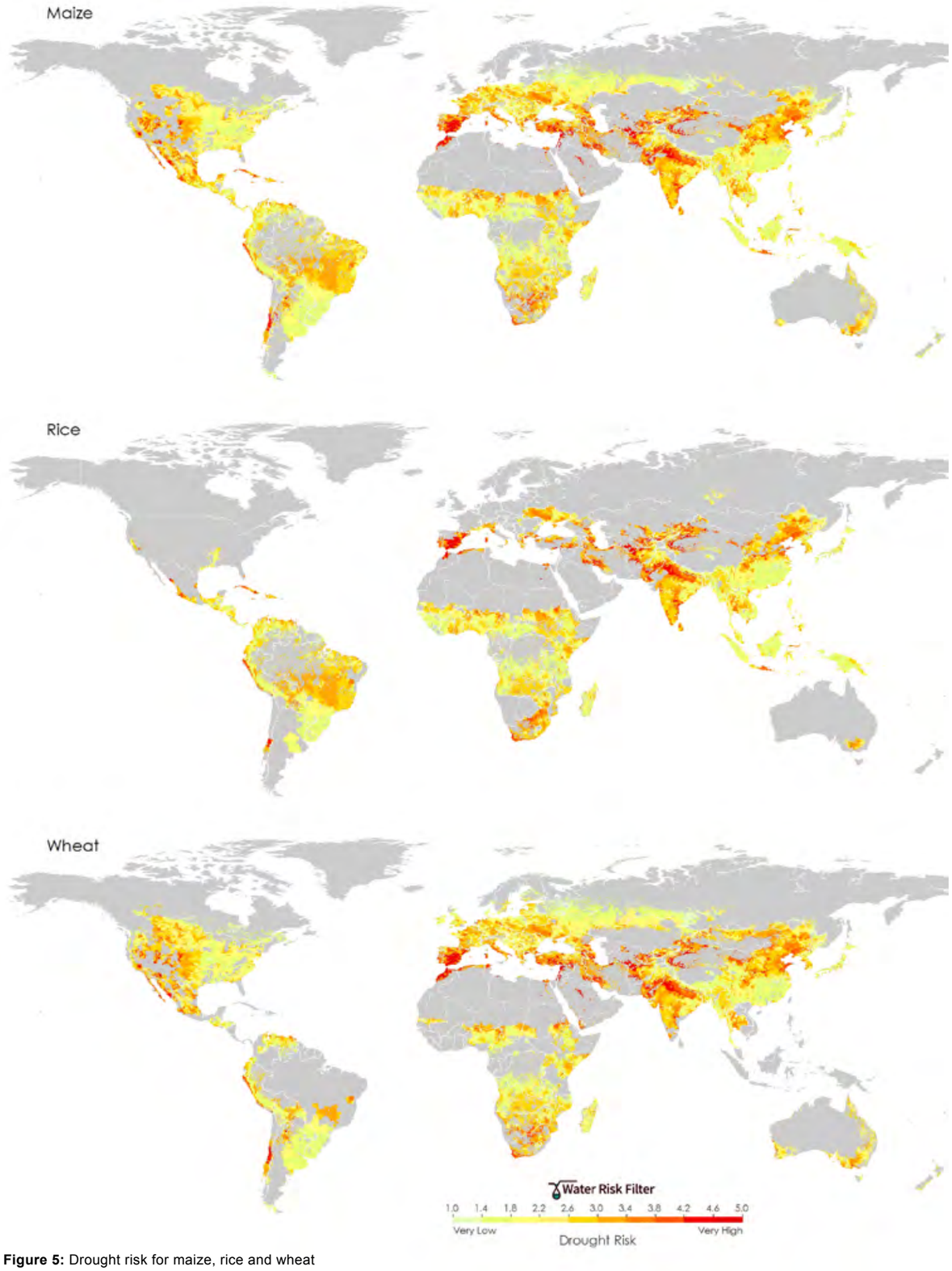


Figure 5: Drought risk for maize, rice and wheat (data source: WWF 2018 and Ramankutty et al. 2018)

The climate protector forest itself is increasingly threatened by global warming. Extreme droughts at ever shorter intervals make forests more susceptible to forest fires.

DROUGHTS & ECOSYSTEMS

The danger of forest fires increases with prolonged droughts. Particularly in the case of increasingly frequent and intense droughts, the time between fires is no longer sufficient for the forests to regenerate, risking permanent forest loss.[21] According to the WWF Forest Fire Report, 84 per cent of the ecoregions critical to the preservation of global biodiversity are threatened by changes in the intensity and frequency of fires.[22]

In addition to the risk of forest fires, the effects of droughts are particularly felt in the availability of water in rivers, lakes, and wetlands. The velocity of the water flowing through rivers slows down, standing waters shrink and dry out. Reduced freshwater input increases the salt content in water bodies and nutrient concentrations usually increase as the water run-off decreases. In many cases, this leads to eutrophication* of water bodies and, when combined with increased temperatures, to a higher probability of invasive species occurring. This in turn can make living conditions unsuitable for many species and lead to a significant loss of biodiversity.[23]

Already in the past, extremely hot and dry years often resulted in a noticeable decline in the animal and plant populations there.[24] According to the WWF Living Planet Index, freshwater species populations are particularly at risk. Since 1970 they have declined by over 80 per cent – more than in any other habitat. Wetlands in particular are home to a great variety of flora and fauna and are a source of food and groundwater for millions of people. But as the present analysis shows, it is precisely these wetlands that are increasingly threatened.

NEARLY 14.4 PER CENT OF ALL RAMSAR WETLANDS ARE LOCATED IN REGIONS WITH A HIGH TO VERY HIGH RISK OF DROUGHT.

Nearly 14.4 per cent of all Ramsar wetlands are located in regions with a high to very high risk of drought. It is therefore to be expected that extreme climate changes will also contribute to the decline in biodiversity in the future. And the services provided by ecosystems, such as the provision of drinking water through natural filtration of precipitation or the reproduction of fish populations as food, are also being increasingly restricted as a result.

* Eutrophication: an excess or increase in nutrient concentration that causes more algae to grow in a body of water. Since other plants then get less light, they can die off. There is a danger that less sensitive or invasive species will prevail, thus leading to an overall decline in biodiversity.

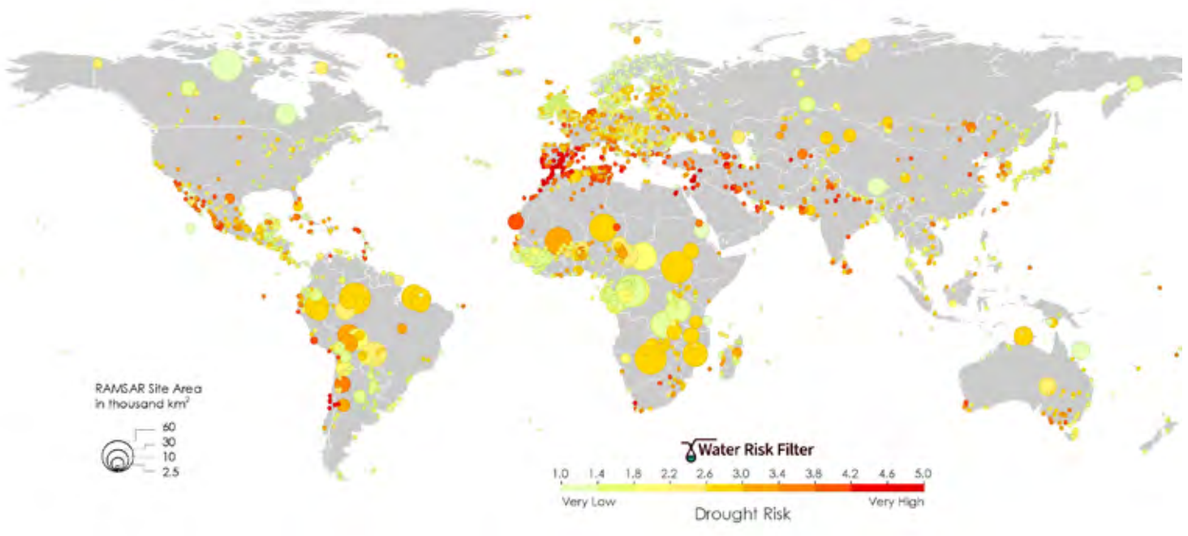


Figure 6: Drought risk for Ramsar wetlands (data source: WWF 2018 and RSIS 2019)

Box 6: Doñana National Park

"Coto de Doñana" is the name given to the landscape shaped by the Guadalquivir River in southern Spain, whose core area is protected as a national park on more than 50,000 hectares. The national park has been designated a UNESCO World Heritage site, a Biosphere Reserve and a Ramsar Wetland of International Importance. But Doñana is in danger of losing its status as a World Heritage site. Since the beginning of the 20th century, more than 80 per cent of the natural swamps have been lost there. The area is one of the most important wetlands in Spain and one of the largest and most impressive nature reserves in Europe. The area is best known for its great diversity of habitats, which are home to over 4,000 different species. For example, the marshes, which are an important habitat for up to six million migratory birds per year and for the endangered Iberian lynx. In recent decades the area used for agricultural production has grown by leaps and bounds – protected forest areas were cleared in some cases to make way for fruit plantations.

The combination of intensive agriculture and severe droughts means that ever greater quantities of water are needed to irrigate rice and strawberry fields or to intensify other crops. These quantities of water are extracted from the natural system, causing the natural areas to gradually dry out. An estimated 1,000 illegal wells and 3,000 hectares of illegal farms also contribute to unsustainable water use.[25] If these management practices, which are detrimental to the natural environment, persist and water continues to be overused, Doñana will not only lose its status as a World Heritage site, but also its capacity to provide valuable ecosystem services to present and future generations.

The "Coto de Doñana" is known for its great biodiversity. But agricultural overexploitation and illegal water use lead to the drying up of vital habitats.

More intense droughts will further intensify the tension between energy generation and water availability.

DROUGHTS & ENERGY SUPPLY

Around 90 per cent of the world's electricity production is heavily dependent on water.[26]
For example, water is needed to generate energy:

- in the raw materials industry for the production of fuels such as coal, uranium, oil and gas,
- to farm energy crops such as corn and sugar cane,
- to cool power plants and transport fuels via waterways.

Conventional (fossil and nuclear) energy sources are the largest consumers. 43 per cent of the total freshwater withdrawal in Europe is used to cool thermal power plants.[27] Assuming that coal-fired power plants will continue to be built, the water required by the energy sector in countries of the Global South would rise by 350 per cent in Asia by 2050, 360 per cent in Latin America and 500 per cent in Africa[28].

43 PER CENT OF THE TOTAL FRESHWATER WITHDRAWAL IN EUROPE IS USED TO COOL THERMAL POWER PLANTS.

A growing world population of an additional 1.7 billion people and their rising incomes will likely increase global energy demand by more than a quarter by 2040[29] – and thus also cause significantly higher water consumption. However, hydropower is also naturally dependent on the availability of water in river basins. Droughts can cause the reservoirs to dry out, and the lower the water level, the less force the water can exert on the turbines.

The analysis of the drought risk for the various energy sources shows that 49 per cent of the world's thermal power plant capacity – mainly coal, natural gas and nuclear power – and 5 per cent of its hydropower capacity are exposed to a high to very high risk of drought. If the planned hydropower plants, especially for the African continent, the Himalayan region and the west coast of South America, were taken into account, this percentage would be much higher.

Overall, 8 per cent and almost 3 per cent of the world's thermal and hydroelectric power plants, which are exposed to a high to very high risk of drought, are located in Europe. In Spain, 138 out of 269 power plants – more than 50 per cent – are exposed to a high to very high drought risk. In France, the 27 power plants with a high drought risk include the nuclear power plants Flamanville, Blayais, Paluel and Penly. High risk of drought also exists in Germany for the Jänschwalde, Boxberg, Schwarze Pumpe and HKW Cottbus coal-fired power plants, as well as the Altheim hydropower plant and the Kirchmöser gas plant, all located in Brandenburg.

California suffers regularly from extreme droughts, which affects hydroelectric power production.

An insufficient supply of electricity can negatively impact the food supply, among other things. For example, energy is needed to produce and distribute water and food: to pump water from groundwater or surface water sources, to operate tractors and irrigation machines and to process and transport agricultural products. Cities also consume a large amount of energy due to their high concentration of industry, transport systems and buildings.

The danger for the future: more intense droughts will therefore further exacerbate the conflict between energy production and water availability.

Box 7: California's vulnerable energy supply

Between 2012 and 2016, California experienced one of its most severe droughts ever, resulting in a shift in energy supply and severe economic and environmental consequences. Electricity generated in hundreds of large California hydroelectric plants is relatively inexpensive compared to almost any other form of electricity. From 1983 to 2013, hydropower accounted for an average of 18 per cent of the electricity supply. In 2011, a relatively wet year, even as much as 21 per cent. But with the drought, the supply fell to around 10.5 per cent of the total electricity produced. In 2015, the driest year of the drought, hydropower even supplied less than seven per cent. In order to compensate for the loss of electricity, focus shifted to more expensive energy sources such as gas. This not only led to an increase in electricity costs, – by approx. USD 2.45 billion between 2012 and 2016 – but also an increase in CO_2 emissions and other pollutants by 10 per cent.[30]

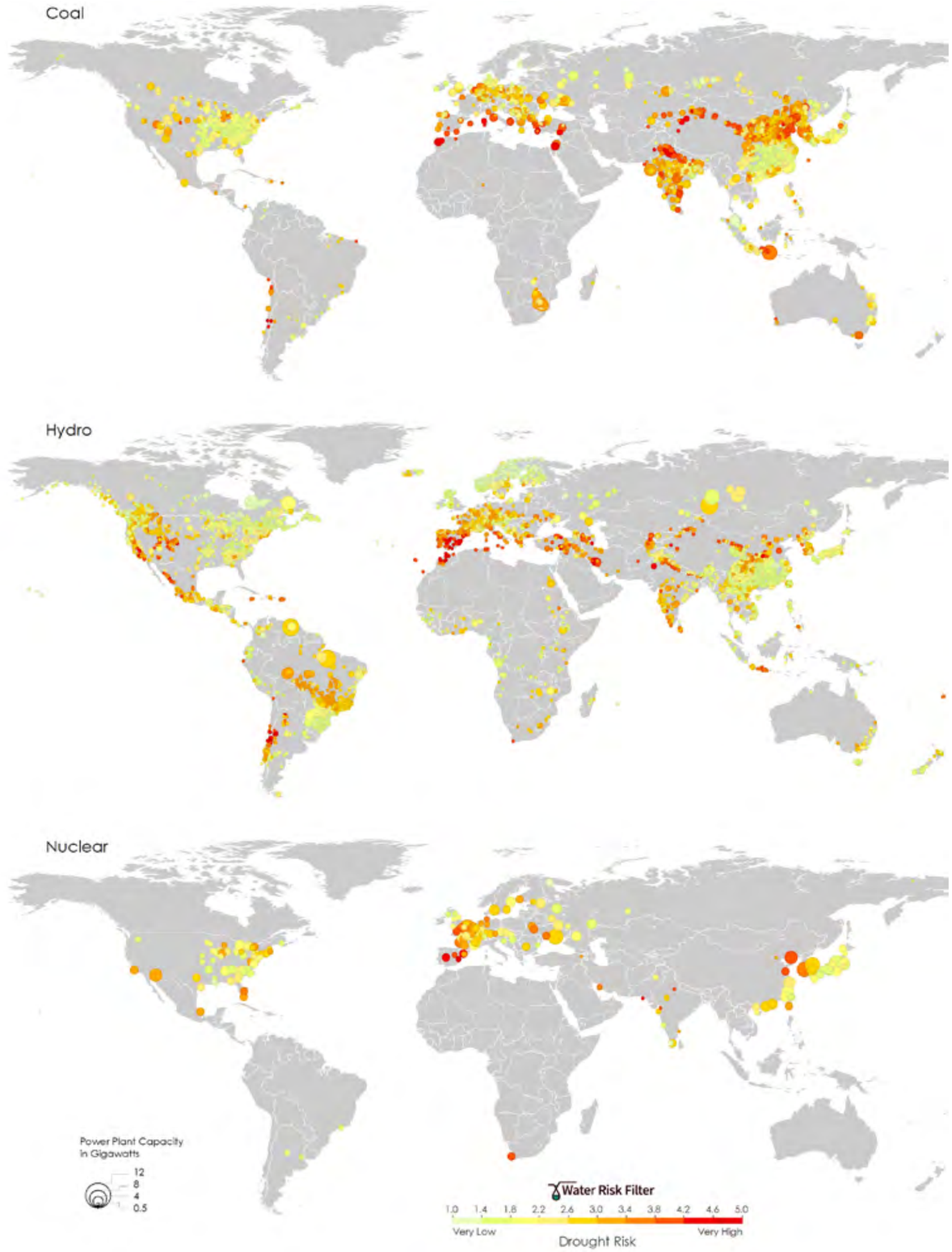


Figure 7: Drought risk for existing power plants (data source: WWF 2018 and Global Energy Observatory, Google, KTH Royal Institute of Technology in Stockholm, Enipedia, World Resources Institute 2018)

Worldwide, conflicts are intensifying due to global warming. Droughts, in particular, can act as catalyst and exacerbate existing tensions.

DROUGHTS & CONFLICTS

NUMBER OF DISPLACED PEOPLE HAS RISEN FROM 43.3 MILLION IN 2009 TO 70.8 MILLION IN 2018.

In the last ten years, the number of displaced people has risen from 43.3 million in 2009 to 70.8 million in 2018, a record high.[31] The United Nations predicts that conflicts will continue to intensify and increase as a result of global warming.[32]

Climate-related threats such as droughts, which are closely linked to food insecurity of small farmers in developing countries and domestic migration, are at the heart of this debate. In addition to the long-term loss of soil fertility, regional conflicts over scarce water resources are increasingly common.[33] For example, there may be disputes over access to and control over water resources, and there is a risk that water supply systems may become the target of terrorist attacks.[34] As a result of these kinds of conflicts and threats, people leave the regions affected.

According to a study, between 10 and 31 per cent of people affected by drought consider moving permanently.[35] Since rural areas are often more severely impacted, rural flight and rapidly increasing urban populations are often the result. However, conflicts can rarely be attributed to a single cause. It is often the interplay of several factors that triggers conflicts and migration. Particularly susceptible are countries with politically unstable conditions where droughts act as catalysts, exacerbating situations with already challenging conditions.

WWF's current data analysis shows that 38 per cent of the areas where is a clear probability of water-related political disputes are also exposed to an increased risk of drought. These are mainly located in the Middle East, where 90 per cent of the land area has the highest risk category; e. g. in Lebanon, Palestine and Israel. Another problem is that these regions are simultaneously areas with rapidly growing populations, which in turn further increases the pressure on water resources.

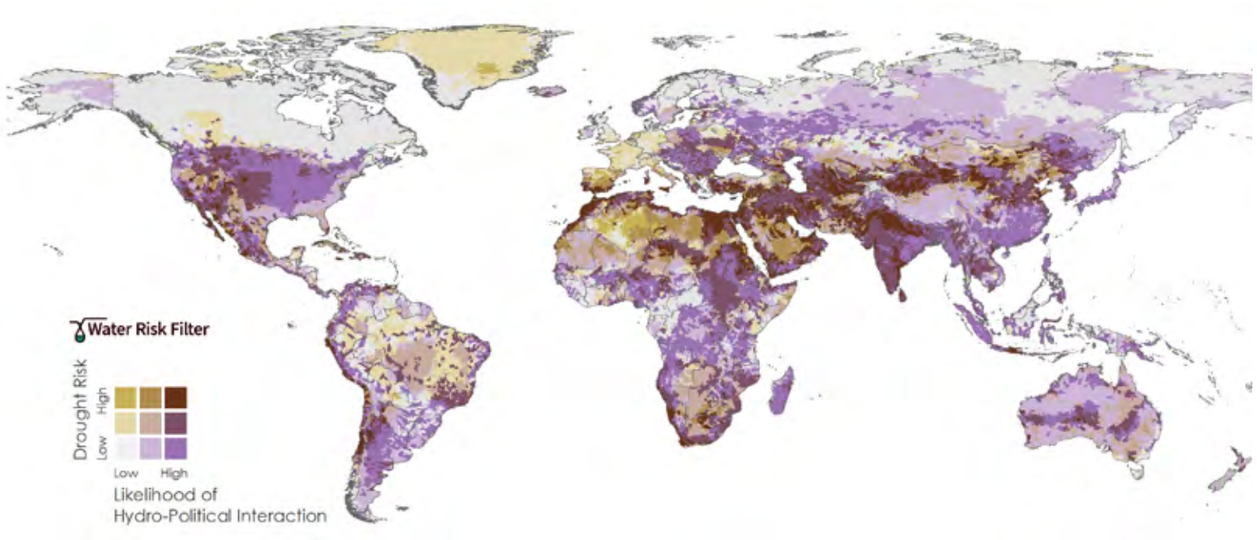


Figure 8: Drought risk and probability of hydro-political interactions
(data source: WWF 2018 and Farinosi et al. 2018)

Box 8: Drought in the Syrian conflict

Starting in 2006, Syria experienced a period of extreme drought lasting several years until 2011, resulting in crop failures, economic problems and displacement of the population. Between 2006 and 2009, around 1.3 million inhabitants of eastern Syria were affected by crop losses:
An estimated 800,000 people lost their livelihoods and basic food supplies as a result. During this period, harvest yields – for example for wheat and barley – also declined by 47 per cent and 67 per cent, respectively. In particular, the combination of very severe drought, extended multi-year crop failures and the associated economic deterioration led to rural flight to cities. The rapidly growing urban population further contributed to urban unemployment, political and social unrest.[36]
Even though the prolonged drought was not the sole cause of the Syrian conflict, it has certainly acted as a catalyst to exacerbate the situation.

Serious droughts, crop failures and related economic losses can result in an urban-rural flight, which in turn can lead to urban unemployment and socio-political unrest.

Even though industrialised countries in Central and Northern Europe still have comparatively sufficient water resources, they are also affected by the risk of drought.

FOCUS: EUROPE

Although Europe has a long history of drought, the frequency and intensity of droughts in this century are unprecedented.[37] The progressive destruction of the natural environment reduces the resilience of ecosystems and leads to greater impacts of extreme weather events. At least eight per cent of the European land mass is affected by desertification. More than 56 per cent of natural wetlands have been lost since the 18th century[38], most of them in the last century. 60 per cent of the remaining rivers and wetlands are not in a good ecological state.

DROUGHTS ARE TO BE EXPECTED IN SOUTHERN EUROPE IN PARTICULAR.

Longer and more frequent droughts, compounded by continuous global warming, are to be expected in southern Europe in particular. Areas that are already suffering from water shortages, like the Mediterranean region, are likely to suffer even more in the future. Southern Spain, the border region between Turkey, Greece and Bulgaria, but also southern Turkey, Armenia and Azerbaijan are considered particularly vulnerable.

In order to respond adequately to and mitigate the impact of the longer and more frequent droughts expected to occur, not only will effective national and European implementation measures be needed in the future, it will also be essential to integrate water scarcity into other national and European sectors, such as agriculture, energy policy and health.

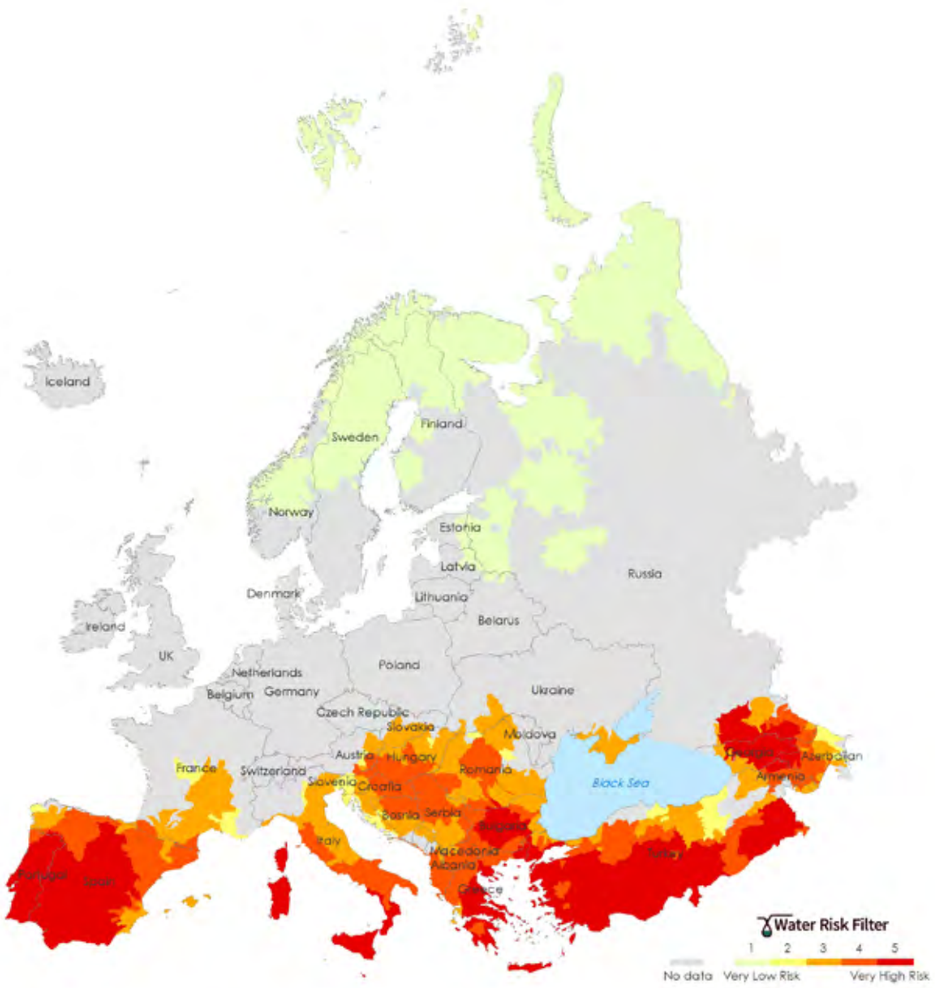


Figure 9: Projected changes in the occurrence of droughts (data source: WWF 2018)

Box 9: The European Water Framework Directive (WFD)

The Water Framework Directive (WFD, 2000/60/EC) adopted by the EU Member States in 2000 fundamentally reformed European water policy. For the first time, water bodies (rivers, lakes, transitional waters, groundwater, coastal waters) were viewed as ecosystems and goals and measures for improving the status of the water bodies were stipulated with concrete timelines. At the core of the directive are a ban on the deterioration of water status and a requirement to improve it. Solutions need to be found to prevent further deterioration in the ecological status of water bodies in order to improve Europe's ecosystems.

Over three six-year "management cycles", the aim is to attain "good" ecological and chemical status by 2027 at the latest. Good quantitative and chemical status must be achieved for groundwater. The Water Framework Directive is thus a global example of a modern integrated water policy. In this context, bodies of water are considered to be transnational units for which international decision-makers and national administrations are jointly responsible. As a result of the directive, EU-wide comparative analyses of our water bodies were conducted for the first time and a network of measuring stations designed for long-term activities was installed.[39]

Particularly in the Mediterranean region, prolonged and more frequent droughts are to be expected. Southern Spain, the border region between Turkey, Greece and Bulgaria, but also southern Turkey, Armenia and Azerbaijan are considered particularly vulnerable.

Directly visible effects of prolonged droughts are mainly low water levels. Ships cannot be fully loaded and, in some cases, shipping traffic has to be completely stopped. The limited supply of raw materials in turn reduces the production of industrial companies.

FOCUS: GERMANY

The drought year 2018 marked the hottest year ever recorded by the Deutscher Wetterdienst (DWD; German Weather Service) and thus clearly demonstrated that extreme weather events have long been expected in Germany as well. Never before have there been so many hot days (over 30 degrees) and summer days (over 25 degrees) as in 2018 – the year thus continued the long-term warming trend as the mean temperature in Germany has risen by about 1.5 degrees since 1881.[40] With over 2,000 hours of sunshine, the excess sunshine[41] 30.5 per cent. Precipitation also remained below the usual levels throughout Germany: at 586 l/m², only 60 per cent of the usual precipitation fell and 2018 was thus also the fourth driest year since 1881. Soil moisture dropped to 30 per cent of its full capacity by September, which had a major impact on agricultural crop yields.[42] It stayed dry, hot and sunny until November, which made the situation with soil moisture even more critical in some parts of Germany.

THE ‘DROUGHT YEAR’ 2018 HAD SERIOUS CONSEQUENCES.

Above-average temperatures and below-average precipitation characterised the ‘drought year’ 2018 and had serious consequences. German farmers in particular were affected by the prolonged drought. At 34.5 million tonnes, the grain harvest was down 16 per cent from the previous year. The potato harvest was also at an all-time low of 8.7 million tonnes[43]. In some regions, crop losses ranged from between 50 and 70 per cent to total losses. In addition, there were threatening field fires, which forced farmers to make emergency harvests. Drought and heat dried up grasslands, which in turn led to problems in the supply of animal feed, especially for sheep and cattle.[44] According to the German Farmers’ Association (DBV), farmers suffered total losses of around EUR 2.5 billion. Support payments totalling up to EUR 1 billion were called for.
In Brandenburg, EUR 72 million from public funds have now been made available by the state and the federal government for farmers who suffered extreme hardship as a result of the 2018 drought.[45]

However, the after-effects of last year’s drought are still clearly evident. This year’s grain harvest has grown under difficult vegetation conditions as the extreme drought of summer 2018 continued during sowing season last autumn. As a result, the DBV had to significantly lower its estimates for the grain harvest. New calculations are based on 44 to 45 million tonnes, which can mainly be attributed to the heat waves. By comparison, the average for the years 2013 to 2017 is 47.9 million tonnes.[46]

According to the Drought Monitor of the Helmholtz Centre for Environmental Research (Helmholtz-Zentrum für Umweltforschung - UFZ), the soil in summer and autumn 2018 was much drier than in all previous years on record since 1951.[47] The recurring dryness this year will now be intensified by the after-effects of the ‘drought year’ 2018. While the groundwater reservoirs were still full at the beginning of 2018 – as 2017 was a very wet year – the conditions at the beginning of 2019 were quite different. Due to the long period of drought, the groundwater reservoirs could not regenerate and the soil was already much too dry at the beginning of this year.[48]

HOW UNUSUAL WAS 2018?

Variability in temperature and precipitation 1881–2018 in Germany

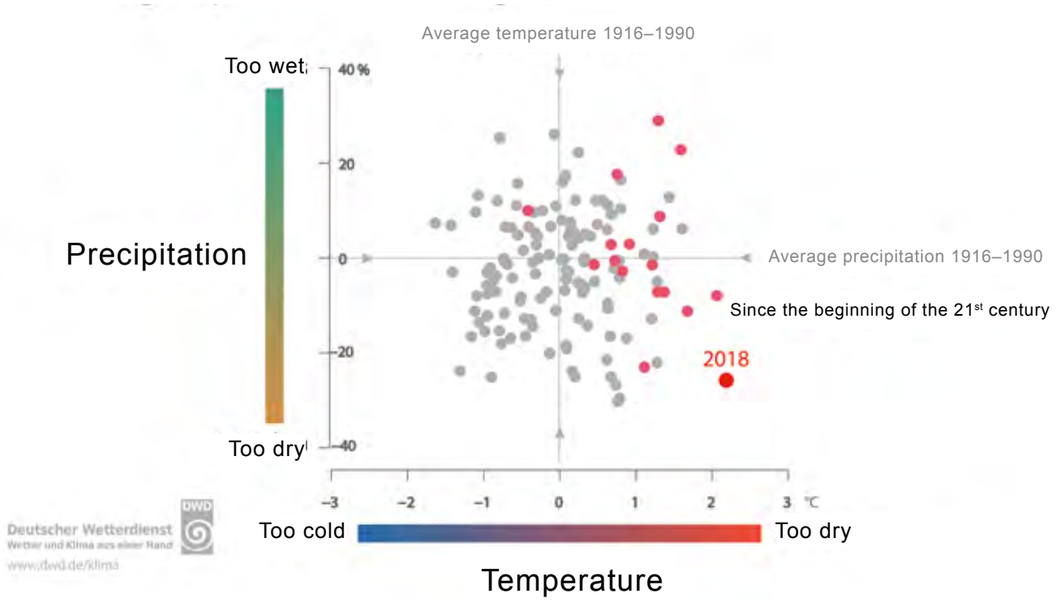


Figure 10: Variability in temperature and precipitation 1881–2018. Thermo pluviograph as of June 2019 (data source: DWD 2019)

And the groundwater situation remains precarious. In the federal state of Saxony, for example, 88 per cent of the measurement stations analysed were below the typical monthly groundwater level by an average of 54 cm (as of 07.08.2019).[49]

These long periods of extreme dryness at ever shorter intervals are also among the key challenges for forestry. For almost two years the forest has been experiencing extreme climate stress, which is why the Bund deutscher Forstleute (BDF), a German organisation representing forestry workers, declared a climate emergency for the forest in July of this year.[50] Forests, which themselves prevent climate change, are now therefore increasingly threatened by global warming. Forestry practices oriented around rapid timber production over the years has led to the creation of conifer monocultures, which are susceptible to droughts, storms and bark beetles.[51] Forest fires are also on the rise, especially in pine forests, as was already apparent this year during the major fire south of Berlin near Jüterbog and particularly in the Lieberoser Heide.[52]

The net damage for 2018 is high: 300 million young plants have dried up, 300,000 hectares have been damaged by bark beetles and another 300,000 hectares by drought, over 600 forest fires have occurred on an area covering 2,500 hectares. The Forstwirtschaftsrat, or Forestry Council, expects losses of up to EUR 2 billion.[53] The damage caused by the bark beetle is estimated to be EUR 270 million. Last year, fires alone caused forest to be lost on an area the size of 3,300 football pitches. Together with other damage such as storms, drought and bark beetles, this represents a forest loss of 110,000 hectares. By comparison: forests cover one third of Germany or 11.4 million hectares.[54] It is estimated that locally adapted mixed forest afforestation would cost more than EUR 500 million.[55]

In Germany, too, we will have to expect more frequent and regular droughts in the future.

In addition to forest fires, the directly visible effects of drought are mainly low water levels. In 2018, it was almost possible to cross the Elbe river near Magdeburg on foot. Ships could not be loaded to full capacity and in some cases shipping traffic had to be completely stopped. As a result, transport was increasingly shifted to rail and road. But even in these cases, heat damage led to road closures and the discontinuation of air and rail transport.

THE ASPECTS LISTED HERE SHOW HOW WIDESPREAD THE IMPACTS OF DROUGHTS ARE ON OUR LOCAL ECONOMY AND ILLUSTRATE THE COMPLEX PROBLEMS ASSOCIATED WITH GLOBAL WARMING.

The restricted movement of goods in turn curbed production in many industrial companies like BASF and ThyssenKrupp as the supply of raw materials was impeded. Petrol stations could not be supplied as a result of cancelled fuel deliveries and fuel prices increased. And we are also seeing the same phenomena this year.

In Brandenburg, for example, water run-off in the Spree and Schwarze Elster rivers has continued to decline and has been in the low water range for many weeks.[56] Power plants are also being forced to reduce their output due to shortages in cooling water. At the Philippsburg nuclear power plant in Baden-Württemberg, for example, the output was reduced by up to 10 per cent in 2018.[57] Lakes also recorded falling water levels; bathing lakes had to be closed because toxic blue-green algae increased rapidly due to higher temperatures and more sunlight. Some areas in the Taunus region declared a water emergency and called for water saving measures.[58]

The consequences of a drought are multifaceted and often immense: vegetation damage, crop losses, forest fires, low water level, increased pollutant concentrations in water bodies, shortage of drinking water, to name just a few. The aspects listed here show how widespread the impacts of droughts are on our local economy and illustrate the complex problems associated with global warming. The DWD warns that the unusual drought in 2018 and 2019 will not remain an isolated event. Rather, these kinds of weather extremes will become more and more likely as the earth heats up. Here in Germany, too, we will have to expect more frequent, if not regular, droughts in the future.[59]

In view of the rapidly advancing global warming and the associated extreme weather events, we urgently need to implement more ambitious climate targets and measures at all levels.

WWF'S CONCLUSIONS AND DEMANDS

As the earth warms up, the frequency, severity, extent and duration of extreme weather events like droughts will continue to increase worldwide. Their far-reaching impacts on local water supply systems, the natural environment, agricultural production, infrastructure, energy supply and the local economy pose major challenges. The fact that we are not sufficiently prepared to handle these challenges as the world's population continues to rise is evidenced not only by the disasters in Cape Town and Chennai – the drought year of 2018 shows that we in Germany are also clearly feeling the effects of global warming and are suffering from the consequences.

WWF therefore calls on the European Commission, the German federal government and the private sector to take immediate action. Sustainable water management must be established, drought risks anticipated and the resilience of water supply systems guaranteed. Strengthening partnerships and collective action is crucial for better water management.

THE AMBITIOUS IMPLEMENTATION OF CLIMATE TARGETS IS NECESSARY TO ACHIEVE SOCIO-ECOLOGICAL AND ECONOMICALLY MEANINGFUL CLIMATE CHANGE MITIGATION AND ADAPTATION TO GLOBAL CHANGES. TO ACHIEVE THIS GOAL, THE WWF MAKES THE FOLLOWING RECOMMENDATIONS ▶

POLICYMAKERS

- The international community must significantly increase its climate contributions in order to limit global warming to 1.5 degrees Celsius. The EU must take the lead with a strong alliance and reduce its greenhouse gas emissions by as much as 65 per cent by 2030 compared with 1990 levels, and take effective measures to underpin the targets of the Paris Climate Agreement. To achieve this, the German government must now give up its opposition to the increase in the EU climate contribution (NDC – Nationally Determined Contribution) and launch an effective climate protection package this year in order to achieve the national 40 per cent reduction target as quickly as possible and the increased 2030 target safely.

- Freshwater protection must be seen as an additional priority issue for adaptation to global warming, especially in the context of the International Climate Initiative of the BMUB (German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety) and within development cooperation of the BMZ (German Federal Ministry of Economic Cooperation and Development) or the EU.

- The European Water Framework Directive is the right legislation to achieve and ensure the necessary objectives of water protection in Germany and Europe and be implemented better and more ambitiously in its existing form.

- Binding social, human rights and environmental standards must be integrated into EU trade, investment and economic treaties. A due diligence law, including mandatory environmental criteria, particularly for water-intensive industries, must be adopted and implemented.

COMPANIES

- Companies are called upon to ensure complete transparency of their supply chains and, with the help of the Water Stewardship approach, to become active in the river basins of important production locations worldwide by identifying their water risks through systematic analyses; develop measures for effective and sustainable water management with relevant actors, and to implement these along their value and supply chains.

- Companies should require certification systems (such as the EU organic standard) to reflect context-based water criteria.

FINANCIAL SECTOR

- The analysis of water risks must be integrated into relevant decision-making processes (e. g. lending and investments).

- The protection of freshwater must be elevated to the level of a priority issue in setting the framework for sustainable financing, e. g. in the EU Sustainable Finance Action Plan and the Task Force on Climate-related Financial Disclosure (TCFD).

- Investment in wind and solar energy, more efficient energy use, monitoring and forecasting systems as well as nature-based solutions to protect and restore wetlands, rivers and lakes must be promoted more intensively.

CONSUMERS

- Everyone can make a difference: eat seasonal, regional and low meat diet; avoid food waste, use products longer, repair and recycle products.

- Encourage companies to be more transparent about the origin of their products and how they reduce water risks in these areas.

- Become active and call for climate change mitigation and nature conservation policies.

Endnotes

1 WWAP, 2019
2 Ligtvoet W. et al., 2018
3 WWAP, 2014
4 IPCC, 2012
5 UNESCO, 2016
6 UNESCO, 2015
7 CDP, 2017
8 UNDESA, 2018 & WWAP, 2019
9 Bastin et al., 2019
10 Hamburger Abendblatt, 2018
11 WWF, 2018a; WWF, 2018e
12 WWF, 2019; Welt, 2019; The Hindu, 2019; der Standard, 2019
13 Zargar, 2019
14 FAO, IFAD, UNICEF, WFP & WHO, 2017
15 Reeves et al., 2016
16 Mekonnen & Hoekstra, 2010
17 FAO, 2015
18 WWF, 2018f
19 FAO, 2015
20 Maingi/OCHA, 2017 & FAO 2017
21 WWF, 2018g
22 WWF, 2016a
23 Jeppesen et al., 2015
24 WWF, 2018b
25 WWF, 2016b
26 WWAP, 2014
27 WWAP, 2014
28 Kressig et al., 2018
29 IEA, 2018
30 Gleick, 2017
31 UNHCR, 2019
32 UNCCD, n.a.
33 Radford, 2019
34 Gleick, 2014
35 Raleigh, Jordan, & Salehyan, 2008
36 Gleick, 2014
37 Hanel et al., 2018
38 Davidson, 2014
39 WWF, 2018d
40 DWD, 2019
41 Compared to the climate reference period 1961–1990
42 Zeit online, 2019a
43 Odenwald, 2018
44 BMEL, 2018
45 MLUL, 2019a
46 DBV, 2019
47 UFZ, 2019
48 Maaß, 2019
49 SMUL, 2019
50 BDF, 2019
51 WWF, 2019b
52 WWF, 2019c
53 BDF, 2018
54 BMEL, n.a.
55 Tagesspiegel, 2019
56 MLUL, 2019b
57 MLUL, 2019b, Handelsblatt, 2018
58 Handelsblatt, 2018, DWD, 2018
59 DWD, 2019

Women harvesting potatoes near the village of Boukima, Virunga National Park, Democratic Republic of Congo, Africa.

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Annex

The drought risk of this data analysis was calculated on the basis of physical risk indicators from the Water Risk Filter (WRF). The global drought risk map is a combined map that shows the indicators with different weightings:

- 20 per cent Water depletion
- 20 per cent Baseline water stress
- 10 per cent Projected change in water discharge
- 30 per cent Estimated occurrence of droughts
- 20 per cent Projected change in occurrence of droughts

To create the various thematic maps, the WRF-based drought risk map was combined with specific spatial data from additional sources.

Based on the WRF, the drought risk was classified on a scale of one to five.
The WRF assumes a high risk (3.51 to 4.5) and a very high risk (4.51 to 5).

Data sources of the thematic maps:

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Forest fires in the tropical rainforest of the Amazon, Roraima, south of Boa Vista, Brazil.

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