

# FACTS ABOUT THE CLIMATE

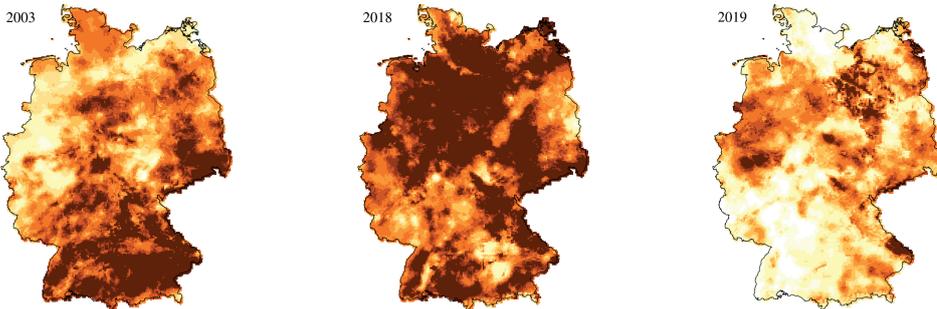
## EXTREME WEATHER: DROUGHT

Droughts are underestimated extreme events: they cause much greater (economic) damage than storms, floods, or heavy rain – but are only visible while they are at full swing. Unlike for other extreme weather conditions, there are no forewarnings and the full extent can only be seen long after the drought begins.

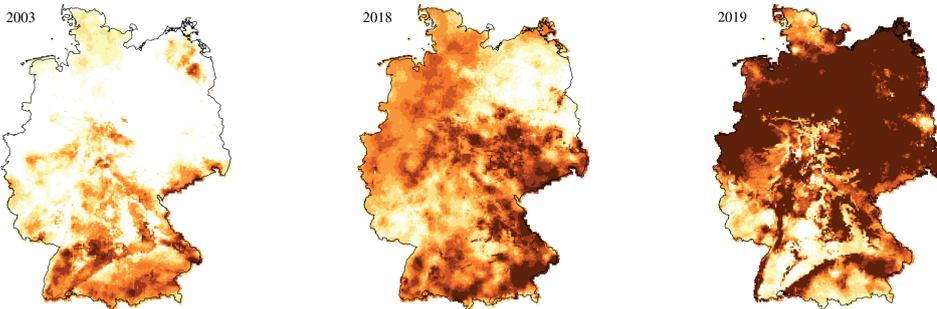
### DROUGHT IN GERMANY

Over the past years, the intensity of droughts in Germany has increased significantly for both the top as well as the entire soil. Especially 2003, 2018 and 2019 were extremely dry. The meteorological, hydrological and agricultural drought led to major socio-economic problems.

Intensity of agricultural drought in the top soil during the vegetation period:



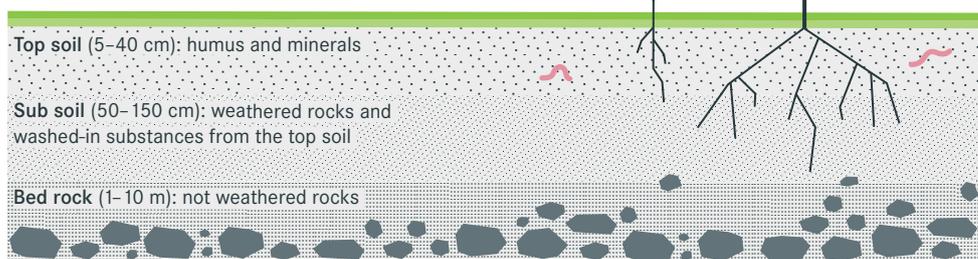
Intensity of agricultural drought in the entire soil during the vegetation period:



The German Drought Monitor provides current information on drought and soil moisture for various applications every day. At the Helmholtz Center for Environmental Research (UFZ) in Leipzig, a hydrological computer model calculates a soil moisture index with five drought classes and color-codes the results on a map: the darker the red, the more intensive the drought. The UFZ-Drought Monitor shows the condition of the top soil (up to 25 cm depth) and the entire soil (up to approx. 180 cm) in separate maps. [www.ufz.de/duerremonitor](http://www.ufz.de/duerremonitor)

### STRUCTURE OF SOIL

Every soil has a characteristic sequence of layers (or horizons) that store water to varying degrees.



### WHAT IS A DROUGHT?



Drought refers to a lack of water, which is either caused by less precipitation and/or a higher temperature than usual.

Science distinguishes four types of drought:

**meteorological:**

a phase (over months or years) with below-average precipitation



**hydrological:**

shortage of available water in wells, lakes, rivers or other reservoirs

**agricultural:**

permanent water shortage in the soil, which affects the growth of plants



**socio-economic:**

long-lasting water shortage with consequences for humans, economy and society

### Heat and drought

Drought and heat are mutually reinforcing each other: When it is hot, soils drain faster. Dry soils in turn absorb water poorly – precipitation runs off the surface before it can seep in. During droughts, the soil cannot cool down naturally: usually, water evaporates under sun rays. Therefore, in arid times, the lower atmosphere becomes hotter and drier.

The effects of droughts will amplify in the course of climate change: With increasing global warming, both summerly low-water situations and agricultural droughts will intensify. The negative changes aggravate significantly between 2 and 3 degrees, so that limiting global warming to a maximum of 2 degrees would be most advisable for Germany. (www.ufz.de/hoklim)

## CONSEQUENCES OF DROUGHT

### Forests

- Water and nutrient deficiency
- More prone to pests, e.g. bark beetles
- Forest fire risk increases
- In 2018 and 2019 approximately 245,000 ha of forest died back (BMEL)

### Economy

- Energy generation: power plants produce less electricity, cold water for cooling is missing
- Limitation of river shipping for goods transport and tourism
- Industrial companies have to cut production
- In 2018, the persistent low water resulted in around 25 million tons less goods being transported by water than in 2017. (Bundesverband der Deutschen Binnenschifffahrt e.V.)

### Ecosystems

- Many species lose habitats and food bases, e.g. when river arms dry up
- Plants become sources of CO<sub>2</sub>: during the day, the photosynthesis rate and thus the integration of CO<sub>2</sub> drops, but at night plants still respire CO<sub>2</sub>

### Cities and people

- Parks and peri-urban forests lose their cooling effect and intensify the heat
- Damage to the infrastructure, e.g. on water pipes by setting the drying soil
- Health problems caused by pollen: Drought intensifies e.g. pollination, because without precipitation, pollen cannot be washed out of the air

### Agriculture

- Significant crop shortfalls: In 2018, the German grain harvest (excluding corn) decreased by around 16% compared to 2017, the lowest since 1994 (Erntebericht 2018, BMEL)
- The risk of wildfire increases
- Dry fields lead to fodder shortages for livestock

## ADAPTATION AND COUNTER MEASURES

### Forests

- Mixed forests can hold more water and are more resilient to drought
- Selection of tree species that are adapted to their habitat and are climate-resistant

### Cities and people

- Citizens can water urban green areas to maintain the "green lung" effect
- Rain retention, local infiltration of rain water

### Economy

- Development of early-warning systems for low water phases
- Include drought effects in operational processes at an early stage, e.g. relocation of transport routes on rails where possible
- Expansion of renewable energies from wind and sun
- Small ships with less draft

### Ecosystems

- Make natural habitats more resistant to drought (e.g. mixed forests, rewetting of originally humid habitats)
- Monitoring of groundwater levels and water abstraction

### Agriculture

- Soils enriched with humus can store more water
- Developing seeds: cultivation of crops that can cope better with drought
- Agroforestry: combine (fruit) trees and fields (e.g. meadow orchards) or valuable wood with conventional agricultural crop sequences

Further information:

### Helmholtz-Klima-Initiative

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An initiative of the Hermann von Helmholtz Association of German Research Centres  
www.helmholtz-klima.de

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