



Bundesministerium
für Umwelt, Naturschutz
und nukleare Sicherheit

Climate change and its impacts on human health

Recommended precautions and steps



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F o r e w o r d

Climate change caused by humans poses a massive challenge for us all – today and in future – due to its wide-ranging impacts on humans, animals and plants. The average global annual temperature already increased by 1°C between 1881 and 2019. In Germany, it rose by 1.6°C in the same period. Even if we succeeded in stopping global warming immediately, some climate-related changes would still be inevitable.

This is why we need a double-track approach to climate policy. Firstly, we must do everything we can to reduce emissions of gases harmful to the climate as much as possible. Secondly, we need to take precautionary action to ensure that the impacts of climate change that can no longer be prevented cause as little damage as possible.

At the end of 2008, the German government adopted a Strategy for Adaptation to Climate Change. Germany's Adaptation Strategy covers a wide range of areas and outlines options for action. For example, because more frequent flooding and higher flood levels can be expected, rivers need to be given back more space and flood protection needs to be improved. In towns and cities there needs to be a greater focus on ensuring that air corridors and open spaces are not built up in order to reduce overheating in urban areas. When constructing new buildings, materials should be used that can withstand high temperatures while also providing good insulation against heat and cold. To make sure our forests become more resilient to the storms and other extreme weather events expected in future, forests dominated by one tree species should be converted into mixed forests with a range of native tree species. It is also important to provide greater protection for settlements in the mountains against avalanches, landslides and rockfalls.

One important element of the Adaptation Strategy concerns health. Which new direct and indirect dangers can we expect as a result of heatwaves, extreme winters, storms and floods? Which pathogens and disease carriers may become prevalent or spread further in Germany due to the predicted rise in temperatures? Does climate change lead to more intense solar radiation and what impacts would this have on health? There are still considerable gaps in knowledge in many areas.

With its action plans on the German Adaptation Strategy (APA I to III), since 2011 the German government has been updating and compiling the specific measures already being taken in Germany to adapt to the impacts of climate change. Regarding health, the Federal Environment Ministry will step up efforts

to educate the public about the health risks of climate change. This brochure is part of this public awareness-raising work.

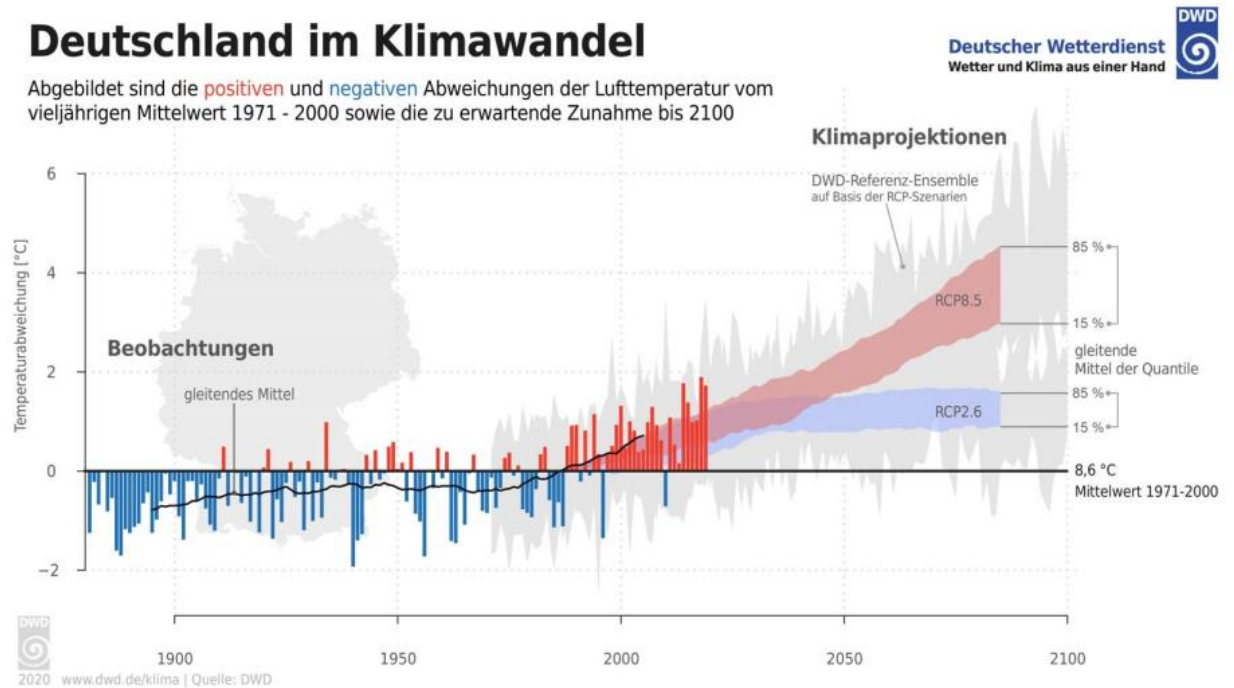
It is also important to expand existing early warning systems, for example the heat warning system set up by the German Meteorological Service (DWD) and the ozone warnings by the Federal Environment Agency (UBA) in order to protect human health. Hospital and care facilities need support so they can assess the dangers to the health of their patients. This not only involves training staff. The premises of these facilities also need to be assessed to determine whether structural changes are needed to make them better equipped to deal with the impacts of climate change. For new buildings, requirements relating to future climate conditions and impacts should be taken into account in the early planning stages.

But each and every individual should also know what to expect – and how to take preventive action. This brochure provides answers to the key questions on the health impacts of climate change. It also highlights options for individual adaptation.

Your team for health in climate change at the
Federal Ministry for the Environment,
Nature Conservation and Nuclear Safety

1. Temperatures on the rise: Germany is heating up too

There are still many unanswered questions about how exactly the impacts of climate change will affect the different regions in Germany. But one thing seems certain: over the next century the number of hot days will continue to rise at our latitudes too. Climate experts also predict more frequent, more intense and longer heatwaves with an increase in what are known as tropical nights. These are strenuous even for people in good health because the temperature does not fall below 20°C at night. Often the humidity is very high during a heatwave and the wind speed is low. This places even more stress on our bodies.



Germany and climate change (source: German Meteorological Service)



Beach in Berlin city centre

Generally speaking it is warmer in large towns and cities than in the countryside. Buildings and roads absorb heat over the day to a much greater extent than forests and fields, which means that the temperature does not drop as much at night. The heat builds up in valley basins in particular. The key factors contributing to a pleasant urban climate are urban greening and air corridors that channel fresh and cool air from the surrounding areas into towns and cities.



Air corridor in the city

A heatwave is a period lasting several days with strong or extreme heat exposure.

1.1. The body has a limited capacity to adapt to heat

The human body has developed effective mechanisms for adapting to a warm environment. By increasing the blood flow to the skin and sweating, the body is usually able to release enough heat from its core to maintain the optimum temperature of 36.5°C to 37.5°C. However, the effort required to adapt stresses the heart and causes circulatory problems, especially in high humidity. Heat can also have a negative impact on sleep and mental wellbeing, and cause aggressive behaviour. Healthy people can adapt to a new climate within a few days. A heatwave may be unpleasant for them but it rarely makes them ill, as long as they follow some rules.



If the temperature hardly drops at night, the body does not have a chance to recover properly. Healthy people, too, should take this into account and try to take things easier in their daily lives. It is also very important to drink enough fluids and to compensate for the salt lost as a result of sweating. At an ambient temperature of 30°C, an adult loses two to three litres of fluid per day through the skin even with just light physical activity. Strenuous physical activity at very

high temperatures can cause a loss of up to ten litres a day. Every litre of sweat contains an average one gram of salt (see *Recommendations for how to cope during a heatwave* below).

Doing sport in scorching heat is unhealthy as the body can reach the limits of its ability to release heat. Overly warm clothes, mouth and nose coverings, excess exposure to the sun, unhealthy eating and alcohol consumption also increase the risk of health damage in high temperatures.

Recommendations for how to cope during a heatwave

- People living in hot countries have always known that they need to stay in the shade or in a cool place around lunchtime. Follow their example and plan your outdoor activities in the morning and evening.
- Avoid vigorous physical activity and being outside in the blazing sun.
- Wear light, thin clothing and a broad-brimmed hat made of a breathable material.



- Drink plenty of fluids, especially water, diluted juices and fruit and herbal teas. Remember that tap water or low-sodium mineral water cannot meet the body's need for essential salts. You can replace the salt lost through sweating, for example by drinking mineral water with a higher mineral content, or lukewarm

broth, or by eating a salty snack. Do not drink ice-cold drinks and avoid drinks containing alcohol, caffeine and a lot of sugar. If you suffer from heart or kidney disease, consult your doctor about what to bear in mind when balancing out fluid loss and whether your medication plan needs to be adapted.

- Eat several small light meals spread over the day: food such as vegetables, salads and fruit containing lots of water like melon. Avoid heavy and large meals.



- Keep cool
 - a) cool your body down using wet cloths on your legs, arms, face and neck
 - b) take cool (not cold) showers or (foot) baths
 - c) dampen your skin with a wet sponge or water from a spray bottle but don't dry off your skin.

- Remember that everyone reacts differently to heat depending on your physical condition and the type of activity on a given day.
- To keep your home as cool as possible, only open the windows at night and in the early morning when the air is cooler outside than inside. Leave windows, curtains and blinds closed during the day.



House with closed blinds

It is also important to remember that the ability to concentrate, both physically and mentally, decreases in hot temperatures. This means an increased risk of accidents – at work, on the roads and in the home. Safety measures that apply in the workplace should therefore also apply to work at home.



What can I do about working conditions in high temperatures?

When the indoor temperature exceeds 30°C, measures in accordance with the Workplaces Ordinance (ArbStättV) must be taken to protect employees' health.

These include

- only airing rooms at night or in the early morning
- relaxing the dress code
- taking advantage of flexitime rules and moving working hours to cooler times of the day
- using blinds and air-conditioning systems effectively.

Important: when using air conditioning systems, make sure that they are inspected at regular intervals to prevent bacteria from accumulating in your unit.

- switch off electrical appliances that are not being used
- provide suitable drinks.

Important: in poorly ventilated rooms where several people are working there is an increased risk of infection with SARS-CoV-2 and of catching COVID-19.

Allowing employees to work from home can help.

1.2. Lessons learned from the extremely hot summers since 2003

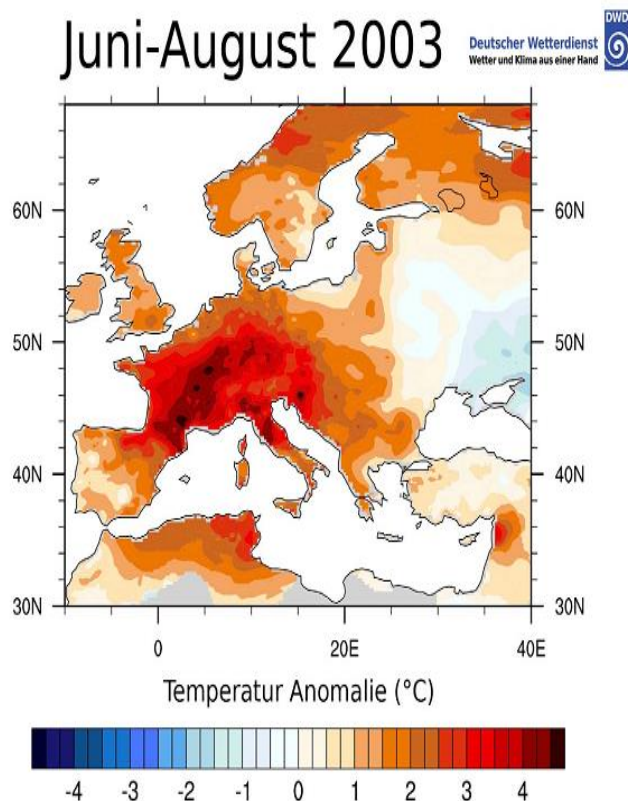
The summer of 2003 clearly showed what happens when a long heatwave hits and the population is unprepared. It was the hottest summer in the past 500 years – and by the end of this century it will most likely be the norm.

Temperatures in some parts of Central Europe can now reach over 40°C.

Heatwaves are more frequent, last longer and are more intense.

At least 52,000 people died in Europe during that extreme summer, either directly or indirectly as a result of the heat. Many of the victims lived in France, where high humidity exacerbated the situation. The majority of those that died were over 70 or under the age of four.

Although some of them suffered from pre-existing medical conditions, it is likely that many would have lived longer if the population had been warned in time and if care facilities had been better prepared.



Map of temperature differences in Europe in the summer of 2003 (source: German Meteorological Service)

1.3. Older and ill people and small children are particularly vulnerable

High temperatures pose a particular risk to older and sick people and to small children. Their bodies struggle to respond properly to the increased temperatures.

The body's complex internal system for heat regulation is not fully developed in babies and small children. When it's hot, their body temperature rises quickly because, relative to their body size, their body surface is larger than that of a young person or adult. And their sweat glands are not yet fully functional. A lack

of fluids also increases the risk of life-threatening overheating. The system that regulates body temperature only becomes fully developed during puberty.

Children need special protection on hot days



In addition to the recommendations in section 1.1 “How to cope during a heatwave”, the following applies for children:

- Make sure their shoulders and neck are covered when in the sun. Clothes should be loose-fitting.
- Head covering made of breathable material is a must for children on hot days.
- Make sure that children drink small amounts of liquid often. The risk of dehydration is even greater than for a healthy adult. Suitable drinks include juice mixed with low-sodium mineral water. Avoid cola and lemonade containing lots of sugar.
- Never leave babies, children or other vulnerable people or animals in a parked car, even for a very short time.



Older people are more vulnerable because their cardiovascular system is less able to transport heat away to the body surface. Their ability to sweat also decreases. Some older people rarely feel thirsty, even after losing a lot of fluids. When fluids are lost the blood volume decreases, which can lead to a drop in blood pressure and make sweating even more difficult. As a result, the body temperature rises. This can lead to heatstroke (cf. section 1.5.3. *Overheating*).

How older people can protect themselves in hot weather

In addition to the general *Recommendations for how to cope during a heatwave* in the box in section 1.1, the following applies for older people:

- Check several times a day that the room temperature does not exceed 26°C
- Turn additional sources of heat like lamps and electrical appliances down or off
- Keep meals very light: a lot of salad, vegetables and fruit
- Ask your doctor whether your medication plan needs to be adapted.

People with cardiovascular or kidney problems, diabetes, diseases affecting the central nervous system or mental disorders such as schizophrenia are particularly susceptible to heat-related illness. People with dementia are also very vulnerable. Taking medication also increases the risk in hot weather. Difficulty in adapting can be expected in particular when this medication affects circulation, the water and electrolyte balance of the body or the nervous system.

This is why precautionary and protective measures are essential for these sections of the population and vulnerable groups (for example people with limited thermoregulation who work outdoors and the homeless). Following these rules will ensure good health on hot days.

What you should be aware of for people in need of care and sick people

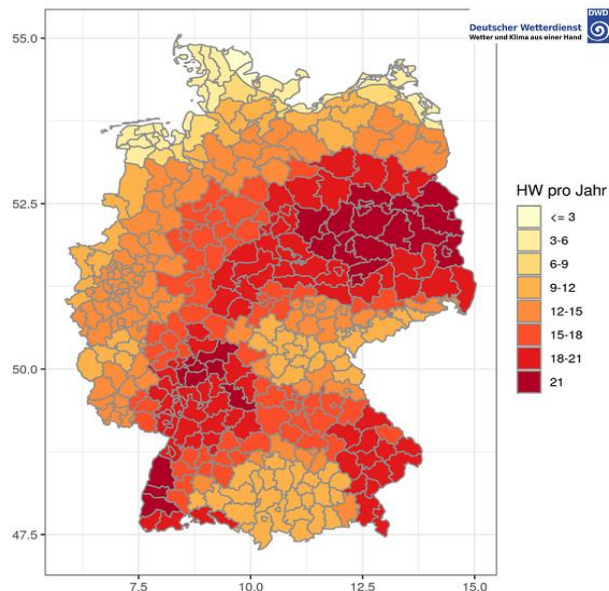


In addition to the general recommendations in the box in section 1.1 "*How to cope during a heatwave*", the following applies for people in need of care and sick people:

- Check several times a day that the room temperature does not exceed 26°C.
- People in need of care should wear light clothing and only have thin sheets or covers on the bed. If possible, use mesh underwear with liners rather than disposable nappies with plastic lining.
- Make sure that they drink enough fluids. And make sure that the salt lost through sweating is replenished.
- Take their temperature – if necessary several times a day. Make sure it does not exceed 37°C. Use lukewarm water to provide cooling or for bed baths. Keep a look out for changes in behaviour, e.g. restlessness, disorientation, confusion (cf. section 1.5 *Heat-related health risks*).
- Ask the doctor whether the medication plan needs to be adapted.

1.4. The German Meteorological Service issues warnings

Heat-related early warning systems were introduced in Europe following the experiences in summer of 2003. In Germany, the National Meteorological Service (DWD) took on this task. If strong or extreme heat exposure is expected, the DWD issues a heat warning daily at 10am for the current and following day. The data is broken down by district. The heat warnings also contain information for older people and city residents, alerting not just hospitals and care facilities in advance of extremely hot weather.



Map of Germany with number of heat warnings in 2018 (source: German Meteorological Service)

Information on whether and where a heatwave might be expected is publicly available online at www.dwd.de/warnungen. You can also sign up for a free newsletter at https://www.dwd.de/DE/service/newsletter/newsletter_hitzewarnungen_node.html.

1.5. Heat-related health risks

Heat can cause illness or can place a strain on organs that are already weak.

Patients with severe symptoms require immediate medical treatment.

Sometimes, the wrong treatment can be more dangerous than the impacts of heat themselves.



Call a doctor immediately (tel. 112) in case of the following symptoms:

- continuous vomiting
- a rapidly rising temperature or a bright red, hot head
- a stiff neck after spending time in the sun
- unconsciousness
- feeling faint
- a seizure
- sudden disorientation or unusual agitation.

While you are waiting for the doctor to arrive:

- Move the person to a cool place.
- If they are responsive, get them to lie down and raise their feet slightly.
If they are unconscious, put them in the recovery position.
- Loosen any tight-fitting clothing.
- Cool any parts of the body that feel hot with cool damp cloths and fan them.
- If they are cold and the skin doesn't feel hot: cover them with a thin blanket or item of clothing.

- If they are awake and not confused, are not vomiting and don't feel nauseous: give them small sips of mineral water or cold tea to drink.

1.5.1. Cramps, nausea, dizziness, exhaustion

Anyone who doesn't drink enough in hot weather runs the risk of overheating. The first signs are cramps, dizziness, nausea and extreme fatigue. At this stage, the person is still awake and responsive, their body temperature can still be normal and their skin is likely to still be cool. The right measures can usually prevent further deterioration.

What should I do?

The person must get out of the heat and into the shade. Tight-fitting clothing should be loosened. Additionally, the person should be covered with a thin blanket or item of clothing, especially if they are cold or their skin feels cold. Cold (but not ice-cold) electrolyte drinks and rest usually help. However, if symptoms worsen or do not go away after an hour, you should call a doctor.

1.5.2. Unconsciousness

Unconsciousness is always a warning sign of serious ill-health. In hot weather, unconsciousness can have several triggers.

If the body becomes too warm due to heat outside the body or inner heat production, it tries to release heat. When releasing this heat, the blood flow to the body surface can increase more than fourfold. As a result of this "redirecting" process, less blood per minute flows through other organs, in some cases including the brain. If the overall volume of blood is too low, for example

because of severe sweating, diuretic medication or a lack of fluids, it can lead to unconsciousness.

Too much sun to the head can also lead to unconsciousness. This is then a sign of a serious inflammation of the cerebral membranes or, in some cases, of the brain tissue. This severe form of "sunstroke" can be life-threatening.

A third and luckily rare cause of unconsciousness is extreme thinning of the blood from drinking too much water. If large amounts of water are drunk without compensating for the salt lost through sweating it can lead to swelling of the brain tissue. This can also be life-threatening.

What should I do?

Call a doctor (tel. 112) immediately! In the meantime, get the person to a cool place if possible and put them in the recovery position. Never give liquids to somebody who is unconscious - they may choke!

This emergency situation takes priority over other generally applicable rules. In other words, distancing rules like those that apply due to the coronavirus do not have to be complied with in such circumstances.

1.5.3. Overheating

Heatstroke develops within a few hours and is life-threatening! If medical assistance is not provided in time there is a very high risk of death – despite treatment in intensive care.

The weather doesn't always have to be extremely hot for heatstroke to occur – sometimes intense physical exertion on a sunny summer's day is enough. Body temperatures of over 40°C have been recorded in marathon runners, for example. 41°C would pose an immediate threat of death because then parts of their metabolism would collapse.



Heatstroke causes an uncontrolled increase in body temperature, which can rise to 39°C or even over 40°C within quarter of an hour. The skin is very hot and often dry. People suffering from sunstroke feel extremely thirsty. Headaches and dizziness are frequent symptoms. Some people have cramps or are disorientated. Unconsciousness is a sign of a reduced blood flow to the brain, resulting in a lack of oxygen. Immediate treatment is always required!

What should I do?

In the case of suspected heatstroke, call a doctor immediately (tel. 112)! In the meantime, get the person to a cool place and follow the recommendations in section 1.5.1 *Cramps, nausea, etc.*

UBA/DWD flyer on climate change and health: *Tipps für sommerliche Hitze und Hitzewellen* (2019):

https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/190617_uba_fl_tipps_fur_sommerliche_hitze_und_hitzewellen_bf.pdf .

Heat action plans

Heat action plans aimed at comprehensive intervention measures help prevent the health impacts of climate change.

Recommendations for drawing up heat action plans in order to protect human health were published for Germany for the first time in 2017. They are primarily aimed at the federal states. The recommendations should ideally be implemented at municipal level. These plans are an important part of the human health field of action in the German Strategy for Adaptation to Climate Change (DAS).

See: <https://www.bmu.de/WS4443>

1.6. Cloudy waters

Sometimes, the quality of bathing waters can take the fun out of swimming. In summer when it is especially hot, bathing beaches sometimes have to be closed because there are too many cyanobacteria in the water.



Blue-green algae in Lake Taihu (eastern China)

These bacteria, which are also known as blue-green algae, can reproduce on a massive scale in high temperatures and with an excess supply of nutrients, for example from untreated wastewater. They form a green carpet on the water's surface or turn the water a cloudy green colour. Cyanobacteria pose a risk to health because some of them produce toxic substances. Anyone who swims in water containing these bacteria and swallows water may experience gastrointestinal problems. Some people develop rashes simply by coming into contact with the water.

Climate change increases the likelihood of a further temperature rise of coastal waters and inland lakes. This increases the likelihood of larger numbers of cyanobacteria. However, whether this happens depends on how clean the water is, in other words on the nutrient supply.

Another problem during hot summers is the emergence of pathogenic types of vibrios (*Vibrio vulnificus*, *Vibrio parahaemolyticus*, *Vibrio alginolyticus* and *Vibrio cholerae* non O1 non O139) in bathing waters in the North and Baltic Seas and in saline inland waters. These vibrios are environmental bacteria that occur naturally and that multiply rapidly in water temperatures of 18°C or more. *Vibrio cholerae* non O1 non O139 can also be found in freshwater, i.e. lakeside bathing

waters. Pathogenic vibrios (especially *Vibrio vulnificus*) can trigger serious, and in rare cases fatal, wound infections when people swim or paddle in the water. The risk of this occurring primarily applies to people with underlying diseases like diabetes mellitus, liver disease, alcohol addiction or those with a weak immune system. Older people are also at risk. The first case of such an infection in Germany was reported in 1994. Since then there has been a continuous rise in vibrio-related infections in hot summers.

During long, hot summers, an increasing number of fatal bathing accidents must also be expected, especially at inland bathing waters without lifeguards.

The websites of the federal states and the Federal Environment Agency provide information about the quality of designated bathing waters (see:

<https://www.umweltbundesamt.de/wasserqualitaet-in-badegewaessern#wie-erhalte-ich-informationen-zur-aktuellen-badegewasserqualitaet>)

2. Severe weather events are becoming more frequent

The average temperature in Germany rose by 1.6°C between 1881 and 2018; this is higher than the global average. In contrast to the temperature, there are significant differences – especially seasonal, but also regional differences – in changes to rainfall in Germany. Although average volumes of rainfall in summer have generally remained stable, winters have become considerably wetter.

As well as heatwaves, climate change is also increasing the probability of more frequent flooding and of flash flooding and rising water levels caused by heavy rainfall. This can happen at any time of the year.

However, there is not yet confirmation of a rise in the number of winter storms like those that hit Germany in 1999 (Lothar), 2007 (Kyrill) and 2018 (storm front

Friederike). However, there is a discernible trend of an increase in such storms in northern Europe.

The local impacts of thunderstorms can vary considerably. One part of town may stay dry while the other experiences a heavy downpour. This is why it is very difficult to predict where exactly a heavy thunderstorm will hit until just beforehand.

Experts expect summer thunderstorms to become more severe in the future, i.e. the risk of damage resulting from uprooted trees, falling objects and hailstorms will increase.



Floods and storms pose a wide range of dangers

The immediate health impacts of such extreme weather events are clear: people can drown or be injured or killed by falling trees and objects or collapsing buildings.



There are also dangers once a storm, storm surge or flooding has passed. In many cases there is damage to infrastructure – with a range of direct or indirect impacts on health.

If buildings have been damaged it may not be possible to heat for a while, resulting in people suffering hypothermia. Perhaps homes are no longer habitable and people become temporarily homeless.

Defective electrical cables are also dangerous. They can trigger short circuits and fires, which in some cases can also lead to dangerous fumes.

It is also possible that after a storm, pollutants or pathogens (for example from overflowing oil tanks or sewage treatment plants) may contaminate drinking water.



Flooded Rhine promenade

There is also a danger that pathogens from flooded fields will enter bathing waters or the surrounding environment.



Infrastructure destroyed by rockfall after heavy rain

Roads may become impassable, which means that the emergency services cannot reach injured or ill people quickly enough, or that access to medical care is generally restricted.

People that experience severe weather events, see others injured or their home destroyed can be traumatised. Such events can also trigger anxiety and symptoms of depression.

3. Ozone pollution: poor air quality on hot sunny days

On sunny hot summer days with blue skies, of all days, some people can experience headaches and a sore throat. Asthmatics and many hay fever sufferers are more sensitive than usual. People playing sport or doing strenuous physical activities outdoors can also be affected. The reason is ground-level ozone.

High-level ozone is very good and important for life on Earth. However, when ozone is formed at ground level as a result of chemical reactions it doesn't protect us – it harms our health.

Where does ground-level ozone come from?

Ozone is a secondary air pollutant that is formed when certain chemical precursor substances are exposed to intense sunlight. These are nitrogen oxides and hydrocarbons, primarily from transport (combustion engines), industry (power plants), households (heating systems) and products containing solvents (varnishes). UV radiation and high temperatures trigger ozone formation, resulting in elevated ozone concentrations at ground level. A period of good weather lasting several days, which often happens in summer, can lead to the accumulation of ground-level ozone.



The increase in ozone pollution in Germany's annual average is primarily associated with higher emissions of the above-mentioned chemical substances in the northern hemisphere, but also with hotter temperatures in summer. The increased number of sunny and hot days with high levels of UV radiation linked to climate change (see section 4. "*Climate change and UV radiation*") could also play a role here.

What is significant is that the concentration of ozone is not at its highest directly near busy roads in city centres; it is highest in the city outskirts and the surrounding areas. This is because ozone is directly broken down by other pollutants that are also present in exhaust gases. Ozone can persist longer and be more concentrated in places with fewer of these other pollutants in the air, such as the outskirts of cities.

People react very differently to ozone. There is no typical risk group. Around 10% to 15% of the German population have a negative reaction to elevated ozone levels. However, babies and small children are a special case. As a rule they belong to the risk group. In relation to their body weight, they breathe

more frequently than adults. This means that their respiratory tracts are exposed to more ozone.

The Federal Environment Agency provides information about the current situation

The Federal Environment Agency publishes the latest data on ozone online and gives projections for the next day. It is possible to subscribe to the ozone newsletter:

<https://www.umweltbundesamt.de/daten/luft/luftdaten/>.

From an ozone level of $180 \mu\text{g}/\text{m}^3$ (micrograms per cubic metre) or when the so-called ozone alarm level is exceeded ($240 \mu\text{g}/\text{m}^3$), the population has to be informed as quickly as possible about levels being exceeded or where this is forecast. This data needs to contain information about the population groups affected, possible health impacts and recommendations for what to do.



Ozone alarm A 5 (1995)

What should I do when ozone levels are high?

Ozone levels are lowest in the early morning. Air rooms in the morning whenever possible.

Strenuous outdoor activities like sport and heavy manual labour should take place in the morning if possible. The highest ozone concentrations are usually reached between 2pm and 5pm.

Help keep the ozone concentration low by leaving your car at home as often as possible and walking, cycling or using public transport.

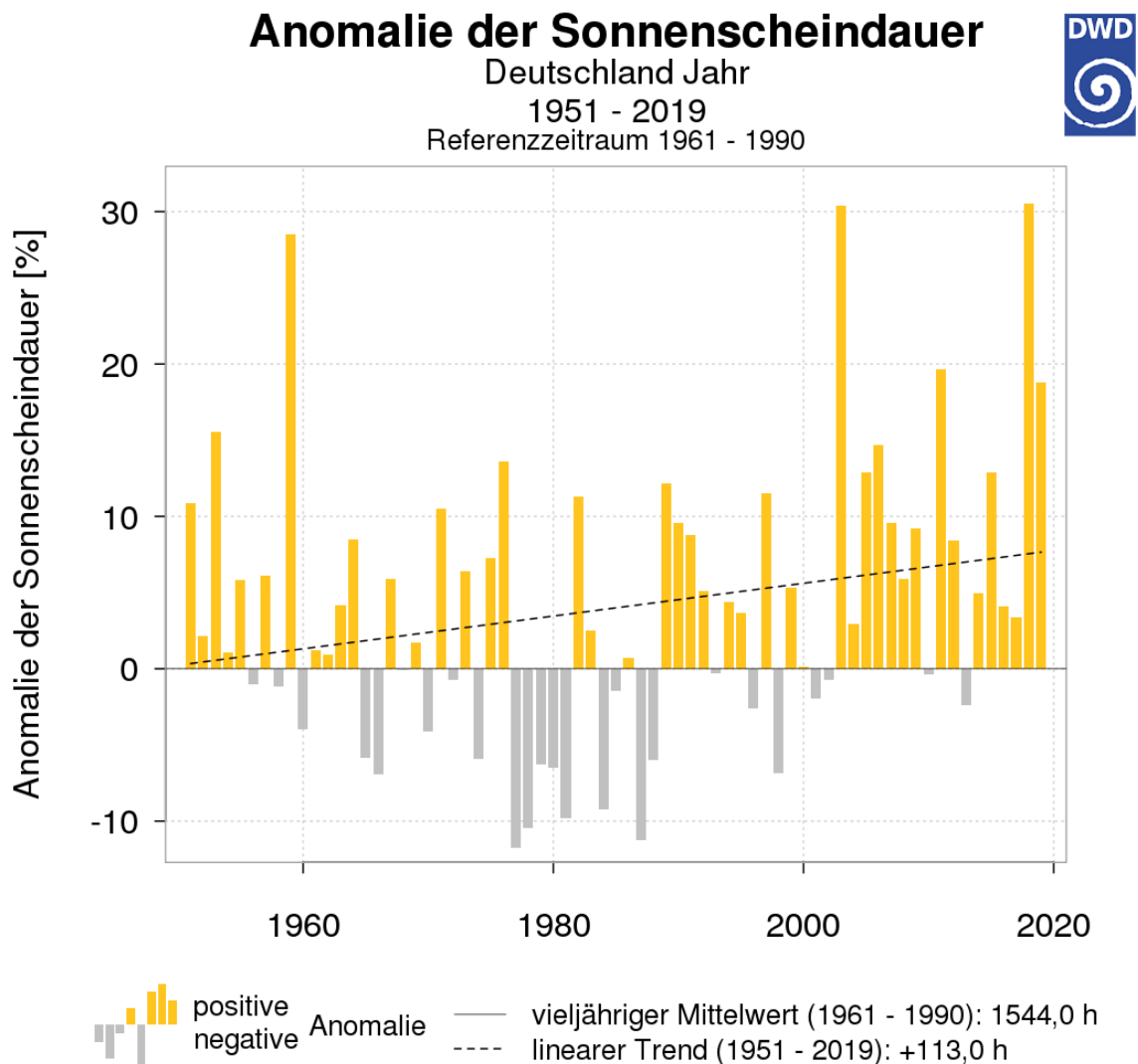
Fuel-efficient driving reduces the emission of harmful gases that foster ozone formation.

4. Climate change and UV radiation

Climate change means that exposure to ultraviolet radiation (UV radiation for short) is also changing. UV radiation is not perceptible to most people. They only notice it when it is too late, for example, when they get a sunburn.

Climate change is said to have increased the frequency of "**low-ozone events**" in the last 20 years. These events are caused by very long and cold Arctic winters, which lead to ozone depletion over the Arctic. When the polar vortex over the Arctic dissipates at the end of winter, the low-ozone air masses can move south – even as far as Germany – at the end of March/beginning of April. Low-ozone air masses allow more UV-B radiation to reach the Earth. This means

that UV radiation is stronger than usual during low-ozone events – and this can have negative health impacts because people’s skin is particularly sensitive to UV radiation in spring. Climate change in Germany has also resulted in an **increase in the hours of sunshine**. More hours of sunshine means more time for the UV radiation to reach the Earth unimpeded, which measurably increases the UV radiation exposure for us all.

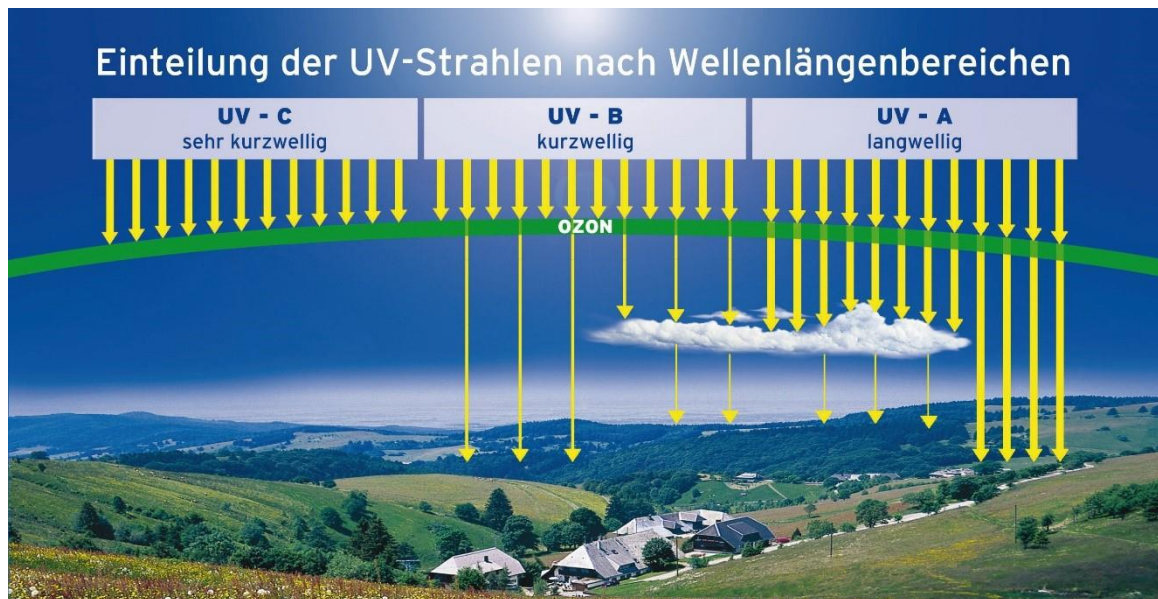


Difference between the annual hours of sunshine in Germany (1951-2018) and the multi-year average (1961–1990). (source: German Meteorological Service)

At the same time, climate change also **affects our behaviour**. Who doesn't like to go outside on warm, sunny days? According to current research, the number of warm days every year will increase thanks to climate change, resulting in a higher dose of UV over the year and more human exposure to UV. However, it can also mean more days of unbearable heat, which would force people to stay indoors. This, in turn, would lower UV exposure.

4.1. What is UV radiation?

UV radiation is the part of solar radiation with the highest energy content. Depending on its physical and biological properties, it is further divided into UV-A, UV-B and UV-C radiation.



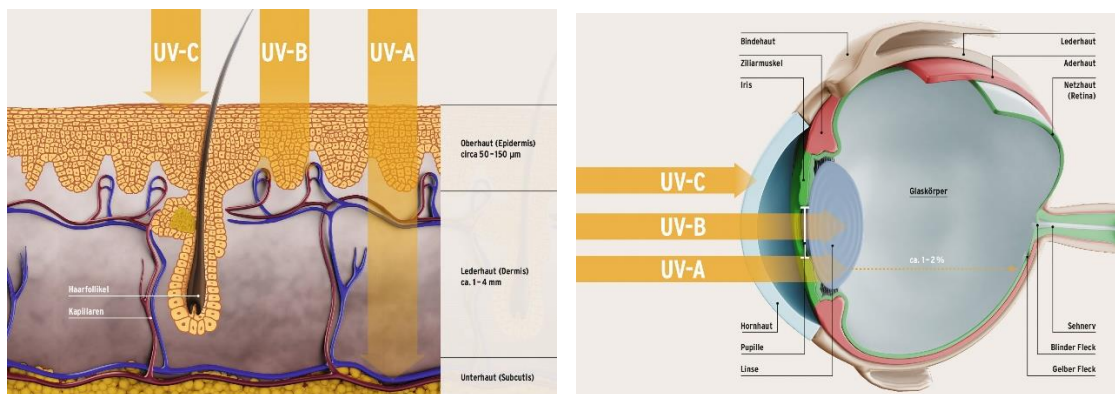
Classification of natural UV radiation by wavelength and transmission through the atmosphere (source: Federal Office for Radiation Protection)

The shorter the wavelength, the higher the energy content and the more harmful the UV radiation. Only part of the radiation from the sun reaches the Earth's surface because the Earth's atmosphere, especially the ozone layer, filters the sun's UV radiation. As a result, no UV-C radiation and only about 10% of UV-B radiation reaches the Earth's surface. If the ozone layer is damaged, more UV-B

radiation reaches us. UV-A radiation reaches the surface of the Earth largely unhindered. The strength of the UV radiation on the Earth's surface is not the same everywhere at any given time: the higher above sea level and the closer the proximity to the equator, the more intense it becomes. It is stronger in summer than in winter and is more intense around noon than in the morning or evening. Thick clouds block UV radiation. Sand and snow reflect it and make it stronger.

4.2. What does UV radiation do?

UV radiation affects our bodies, mainly our eyes and skin. The health impacts of UV radiation on our eyes and skin depend, among other things, on how deeply UV radiation penetrates the tissue. UV-A with wavelengths from 315 nanometres (nm) to 400 nm penetrates deeper into the eyes and skin than the shorter-wave UV-B radiation with wavelengths from 280 nm to 315 nm.



Depth of UV radiation penetration into the skin **(left)** and into the eye **(right)** (source: Federal Office for Radiation Protection)

The health impacts can be immediate, such as damage to the genetic material in cells reached by UV radiation, followed by tanning of the skin to protect against further damage, or sunburn or conjunctivitis and corneal inflammation of the eyes. Sometimes the effects of UV radiation only emerge after many years in the form of premature skin ageing, irreversible eye diseases and – in the worst case

– skin cancer. UV radiation is proven to be carcinogenic and – like asbestos or ionising radiation – classified as a carcinogenic agent in the highest risk group I. UV radiation is the main cause of skin cancer. According to estimates based on cancer registry data, around 23,200 people in Germany were diagnosed with malignant melanoma and around 230,000 with non-melanocytic skin cancer (basal cell carcinoma and squamous cell carcinoma) in 2016. However, the actual number of non-melanocytic skin cancer cases is likely to be much higher as many cases have not been registered. In 2016, around 3,000 people in Germany died of malignant melanoma and around 900 people of non-melanocytic skin cancer. The rate of new skin cancer cases has more than doubled in Germany since 2000. This situation could worsen with climate change.

4.3. What do I have to do?

The most important rule: don't get a sunburn! Each case of sunburn is one too many because every sunburn increases the risk of skin cancer!

What to do:

- **Avoid frequent, prolonged and intensive exposure to the sun. Use the UV Index as a guide** (see UV Index section below). Seek shade or stay indoors at lunchtime – the siesta in southern countries definitely serves a purpose. Add shade to outdoor living areas to help against the heat. Grass, trees and greenery on walls, ceilings and building façades also help protect against UV radiation – with a pleasant cooling effect – and help fight climate change by capturing carbon dioxide. It is also very helpful to shift outdoor activities to the morning and evening.
- **Cover yourself.** When you go outside, the clothes you wear should preferably have a certified UV protection factor. Wear a head covering that shields your forehead, neck and ears, and protect your eyes with a pair of well-fitting sunglasses labelled UV400.

- **Use sunscreen.** Apply adequate sunscreen to all uncovered parts of your body (for adults, about 30 to 40 millilitres for the entire body, which corresponds to about 3 to 4 heaped tablespoons). Make sure that the sunscreen has a high to very high sun protection factor (SPF). For children this should be at least 30, for adults at least 20. People with fair skin unaccustomed to the sun and sensitive skin types should always use a sunscreen product with a very high SPF (50+).

But remember: sunscreen products only delay the occurrence of a sunburn. Even if you use sunscreen, part of the UV radiation still penetrates and damages your skin before a sunburn even occurs. This is why sunscreen should never be used to prolong the amount of time you spend in the sun indefinitely. Don't be in the sun more than 60% of the time recommended for each sun protection factor.

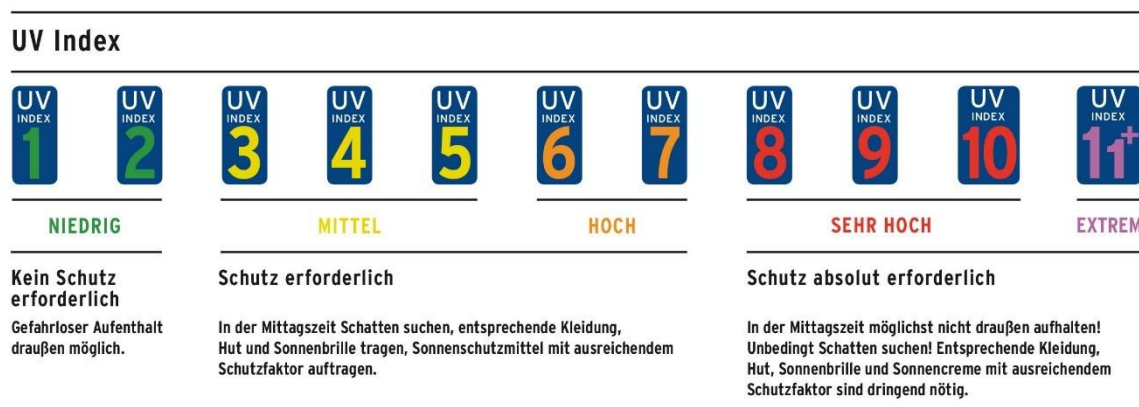
- **Children need special protection.** This is because their skin is much more sensitive to UV radiation than adult skin. Infants should never be out in the blazing sun. And the eyes of children and adolescents also absorb much more UV radiation than adults, which can penetrate as far as the retina. Find a shady spot for them and make sure they wear clothing suitable for the sun. Don't use sunscreen during the first year. It is an absolute must to follow all sun protection rules for children. Sunburns during childhood increase the risk of malignant melanoma by a factor of 2-3! This type of skin cancer is particularly dangerous because it spreads and, if not detected at an early stage, can be fatal. This is why it is important that adults set an example when it comes to sun protection.

UV Index: information from the Federal Office for Radiation Protection and the German Meteorological Service

For effective UV protection, it is important to know the intensity of UV radiation and its potential to damage human skin. This is published in a globally

standardised UV Index (UVI;

<https://www.who.int/uv/publications/globalindex/en/>).



The UV Index (source: Federal Office for Radiation Protection)

The UV Index is a measure of the expected daily peak intensity of UV radiation on the Earth's surface and an indicator of the potential for skin damage. The higher the index value, the higher the UV radiation intensity and the less time it takes for a sunburn to occur on unprotected skin. In Germany, levels of 8 to 9 are reached in summer; at the high altitudes of the southern German mountain regions even as high as 11. Values of 12 and higher are possible at the equator. Since individual UV Index ranges are associated with different recommendations for protection from the sun, the UV Index also serves as a guide for when to use which protective measures. In Germany, the UV Index is determined by the Federal Office for Radiation Protection (BfS) and the German Meteorological Service (DWD), which provide this information on their websites (www.bfs.de/uv-index and www.uv-index.de) as well as via UV Index apps, weather apps and in weather reports on various media. In addition to the expected daily peak level of the UVI, the BfS also shows the change in UV radiation intensity over the course of a day (current daily progressions) at the respective measuring stations (https://www.bfs.de/DE/themen/opt/uv/uv-index/aktuelle-tagesverlaeufo/aktuell_node.html);

<https://www.imis.bfs.de/geoportal/>) so that people can better adapt their activities to changes in UV radiation intensity during the day.

UV newsletter with 3-day UVI forecast (Federal Office for Radiation Protection):

From April to September, the Federal Office for Radiation Protection publishes the expected UV index levels for the next three days each Monday, Wednesday and Friday – on its website and in a newsletter, which can be subscribed to at www.bfs.de/uv-newsletter. It shows two daily peak values of the UV radiation harmful to human skin: one for cloudy skies and one for clear skies (clear sky forecasts are provided by the DWD). This shows how UV exposure increases as the sky clears up.

The German Meteorological Service's UV Index warning

You can subscribe to a free newsletter by email for your own district from the German Meteorological Service online at https://www.dwd.de/DE/service/newsletter/newsletter_uv_node.html for the period from 1 April to 31 August of each year. This way you are immediately notified if a UV Index warning is issued.

5. Infectious diseases: health risks posed by animals

Among the most common pests that can pose a serious threat to human health by transmitting infectious pathogens to humans are blood-sucking insects such as ticks and mosquitoes as well as rodents. Since they live in different habitats outside of buildings, they are directly and indirectly exposed to and affected by the impacts of climate change. These impacts can vary depending on the species and region, e.g. on their prevalence, distribution, population size, activity, places to hibernate and on their ability to transmit infectious pathogens. Climate change may also encourage the emergence of new species not native to Germany. To protect against infectious diseases transmitted by pests, it is important to minimise the risk by informing yourself.

Ticks



The *Ixodes ricinus* tick looking for a host

In 2019, 12,260 cases of borreliosis, also known as Lyme disease, were reported in humans to the Robert Koch Institute (RKI) by nine German states and 445 cases of tick-borne encephalitis (TBE) were reported throughout Germany (data as at June 2020). This means that ticks are still the most common transmitters of infectious pathogens to humans in Central Europe (for more information about possible pathogens, see the following section 5.2). The most common tick species in Germany, the castor bean tick (*Ixodes ricinus*), can be found throughout the country and is the primary vector of TBE viruses, borrelia and

others pathogens. And it is not just adult ticks that pose a risk for humans. The tiny nymphs of the castor bean tick, which are 1 mm in size, represent an increased risk of infection as they occur in higher numbers and, compared to the even smaller larvae, have a considerably higher prevalence of pathogens. But they are easier to overlook than adult ticks because they are so small. Also relatively widespread in Germany are the ornate cow tick (*Dermacentor reticulatus*) and regionally the ornate sheep tick (*Dermacentor marginatus*). Ticks in the *Haemaphysalis* genus, including the *Haemaphysalis concinna*, a common rodent tick species, have been relatively rare to date.

Not every tick bite is dangerous. However, if a tick is infected with a pathogen and can stay attached to its host for enough time to transmit the pathogen, it can be dangerous to humans and animals.



Feeding nymph

Current research findings show that climate change may create favourable conditions for ticks. This does not just apply to native species, but also to ticks not endemic to Germany that prefer warm climates like the *Hyalomma spp.* and *Rhipicephalus spp.*, which find their way to Germany as parasites on animals, for example. They can also bring new pathogens to Germany from their countries of origin. Whether these previously non-native tick species can survive in Germany must be monitored, as well as the pathogens they carry.

5.1. The castor bean tick – the most prevalent tick species in Germany

This tick species becomes active as soon as the temperature increases above around 4°C to 7°C. In addition, they need high humidity as they absorb water from the air to meet their water needs. They especially like habitats like oak-beech mixed forests or similar forests with distinctive undergrowth and fallen leaves. They can be found in a range of biotopes (e.g. also in parks, gardens, etc.). One generation lasts around two to four years. To develop from the larva into a nymph and finally into an adult animal capable of reproduction, the tick needs a blood meal lasting several days at each stage and attaches its mouth to the host at a protected spot on the host's skin. It takes about 7-10 days for the blood to be absorbed in adult female ticks; their body weight reaches about a hundred times its normal weight.

As climate change progresses, pushing temperatures in Germany and Europe higher, the living conditions for ticks and their hosts are changing, as are the pathogens that are transmitted. The castor bean tick has been able to spread further to northern Europe and has also been detected at altitudes as high as 1,200 metres. Depending on the temperature and weather conditions, ticks can, for example, be increasingly active earlier in the year or even until the end of the year, can extend their period of activity over the course of the year, shorten their development periods or find better hibernation conditions. Ticks struggle to survive during dry periods due to a lack of suitable habitats. The castor bean tick is adapted to an especially wide range of hosts. Adult ticks wait in vegetation mainly for larger mammals while nymphs and larvae prefer smaller mammals including rodents. However, they also infest birds, for example. If the population densities of host animals like mice (see section 5.3. below – *Rodents can transmit hantaviruses*) increase due to mast years of trees as a result of climate conditions, the ticks can develop and multiply well. But a tick often has to wait days or months for a host. The tick can detect whether a person or animal is nearby through body heat and substances like carbon dioxide and butyric acid,

which are produced when exhaling or sweating. It can then gradually move closer to where its hosts are likely to pass by and into a waiting position. It is therefore easy to encounter ticks when hiking and participating in other outdoor activities. The castor bean tick lurks in vegetation where it waits for its preferred hosts to brush past. It has very well-adapted feet with double claws and adhesive pads allowing them to stick to surfaces. Nymphs and larvae can also stay on the ground, in the case of nymphs in fallen leaves along the edge of the path. If people sit down for a picnic right next to a tick and the tick has enough time, it can also crawl to its host (up to a maximum distance of 1.40 m).

The tick very carefully selects a comfortable, sheltered spot on the host's body where it can feed for several days with no interruptions. The search for the right spot can sometimes take hours. It then penetrates the skin of its host and digs its mouth, which is covered with backward-facing hooks, under the surface of the skin. It releases a cement-like substance in the process that keeps the tick firmly attached. At the same time, chemical substances in its saliva stop the blood from clotting and prevent the host from feeling the attached tick. In the case of borrelia bacteria, it usually takes several hours for the pathogens to reach this spot, but it can happen very quickly with TBE viruses.

5.2. Ticks transmit dangerous disease pathogens

The most prevalent and most widespread viruses in Germany are TBE and *Borrelia spp.*, but other pathogens such as *Rickettsia spp.*, *Anaplasma spp.*, *Ehrlichia spp.* and *Babesia spp.* can also be transmitted by ticks and should not be overlooked in a medical diagnosis. *Hyalomma spp.* ticks, which have been increasingly brought to Germany since 2018, have been attracting considerable attention, e.g. as vectors for *Rickettsia spp.* and as potential vectors for viruses such as Crimean Congo haemorrhagic fever (CCHF).

5.2.1. Lyme disease (borreliosis)

Borrelia are widespread throughout Germany, as are the ticks that carry them. Borreliosis caused by these spiral-shaped bacteria is a disease with very different manifestations. The pathogens are transmitted to animals and humans by ticks.

If a tick is infected with *Borrelia burgdorferi s.l.*, these bacteria can be transmitted from the tick to its host if the tick feeds for long enough. Depending on the type of borrelia, a red ring-shaped rash can form around the tick bite days later, which gets bigger within hours (known as migrating redness or erythema chronicum migrans). If no migrating redness is visible, there are often no clear symptoms that would suggest a Lyme disease infection. If a tick bite goes unnoticed, the risk of overlooking an infection is particularly high. If the person feels listless in the first few days or weeks after the bite, has headaches and fever or muscle and joint pains which have no other causes, it is important to clarify any suspicion of Lyme disease or other tick-borne diseases. However, some people do not initially show any symptoms. But the tick bite should not be forgotten. If the borreliosis remains untreated and the disease progresses, this can lead to severe symptoms within months, including chronic joint damage, damage to the central nervous system and/or heart muscle damage.

If the borreliosis is detected early enough and treated with suitable antibiotics, it is usually harmless.

5.2.2. Tick-borne encephalitis (TBE)

TBE is now more widespread in Germany than it was a few years ago. The pathogen in this case is a virus. The TBE virus can already be transmitted when the tick first attaches itself and releases saliva into the bite.

Usually about one to two weeks after the tick bite, people initially suffer from vague symptoms such as headaches, aching limbs and high temperature. The vast majority fully recovers after a few days.

However, about one third of those infected, following a week with no fever, show the full range of clinical symptoms: in these cases, the cerebral membrane and often other parts of the brain or nerve roots in the spinal cord become inflamed. The rule of thumb is: the older the patient, the more severe the disease. In rare cases, TBE can even lead to death.

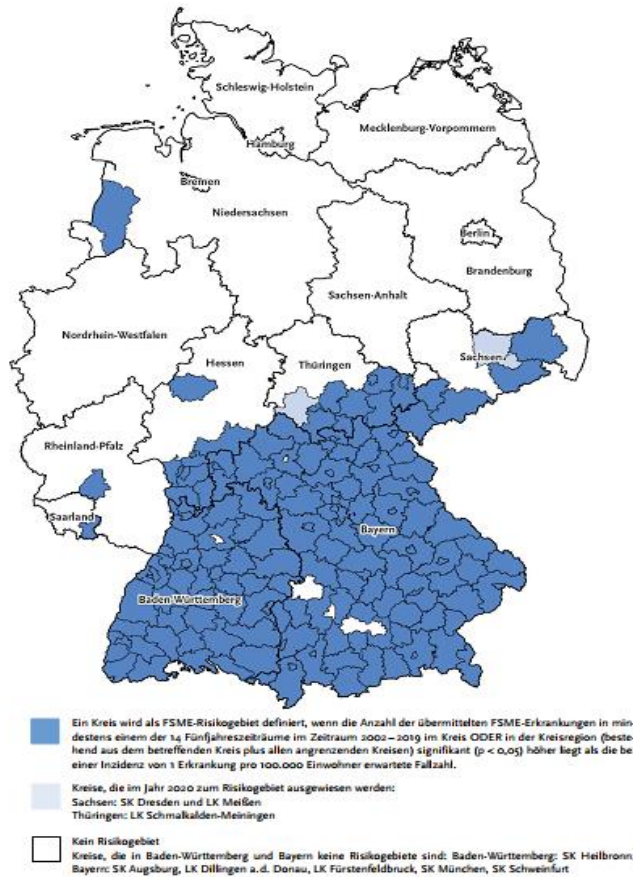
Regions where several people have contracted TBE within a specific time period are designated as risk areas by the Robert Koch Institute (RKI). The risk areas in Germany usually include the federal states of Baden-Württemberg and Bavaria, but also parts of Hesse, Thuringia and Rhineland-Palatinate. In recent years, the number of countries considered to be particularly high risk has increased. The RKI provides an updated overview online and publishes the distribution maps, e.g. at:

https://www.rki.de/DE/Content/Infekt/EpidBull/Archiv/2020/Ausgaben/08_20.pdf?__blob=



FSME-Risikogebiete in Deutschland

Basis: FSME-Erkrankungen in den Jahren 2002–2019, die dem RKI übermittelt wurden, n = 5.479;
Stand: 16.1.2020



Map of TBE risk areas in Germany (source: Robert Koch Institute)

Vaccination possible

If someone has contracted TBE, the doctor can only treat the symptoms. This is why prevention is so important: it is possible to be vaccinated against TBE.

The recommendations on when this is advisable are published by the Standing Committee on Vaccination (Ständige Impfkommission) at:

<https://www.rki.de/DE/Content/Infekt/Impfen/ImpfungenAZ/FSME/FSME.html> .

You can find more information about the vaccine here too.

Better prevention

If you want to walk through meadows with tall grass or through bushes, you should wear long trousers and sturdy shoes and tuck your trouser legs into your socks. Ticks are easier to see on light clothing.

When properly applied, insect repellents can help protect against ticks. It is important to use an approved product that has been tested by the authorities for safety and efficacy (e.g. approved as a biocide) and to strictly follow the instructions for use and warnings. However, repellents are not 100% effective. If ticks reach parts of the body where no repellent has been applied, they can start looking for a place to attach themselves.

It is advisable to be careful during outdoor excursions and scan your entire body and clothing for ticks upon return. Ticks like thin-skinned, protected body parts such as the back of the knee, the crook of the arm and the armpit area. But they can be found anywhere on your body, including the hair on your head.

If you live in a TBE region or want to spend a holiday in places where ticks are prevalent, you can be vaccinated.

In order to prevent transmission from pets to humans, it is advisable to thoroughly search pets for ticks or to treat them with tick repellent.

Information about ticks and ways to protect yourself is provided by the Federal Environment Agency at www.umweltbundesamt.de/Schildzecken under the keyword "Zecken" (ticks).

What to do if you are bitten by a tick

If you discover a tick on your body, it must be removed as soon as possible. The longer the tick is attached to your body, the greater the probability that an infected tick will transmit pathogens.

The ideal implement is a narrow, firm pair of tweezers with a curved tip, which can be easily placed on the skin. Grasp the tick's head as close to the skin as possible and pull the tick out completely. There are also various tick removal tools available, some more suitable than others. If nothing else is available, you can also use your fingernails in an emergency. Be careful not to squash the tick's body to prevent the pathogens from being released.

Never sprinkle oil, rubbing alcohol, alcohol or other substances on the tick as these could stimulate the tick to release more saliva into the wound.

Continue to monitor the tick bite and watch for symptoms of the disease in the period that follows. If you suspect that you have been infected by the tick bite, consult a doctor.

5.3. Rodents can transmit hantaviruses

Dangerous mice

Hantaviruses are widespread throughout the world and are transmitted through rodent droppings. While rodents can easily live with the virus, humans infected with it usually fall ill for a while, suffering not only from fever, but also from headache and muscle pain, nausea and vomiting. Some people also suffer from mild to severe kidney disease. The people afflicted came into contact with rodents or their faeces, for example while cleaning barns, garages or attics or removing dead mice. It is not enough to wear gloves: the hantavirus usually makes its way into the human body through inhaled dust that has been stirred up. The only thing that can help is wearing a respiratory mask and preventing dust from accumulating. It is also possible to become infected through skin wounds and bites.

The bank vole is the most common vector of hantaviruses in Germany. The number of bank voles fluctuates from year to year and is determined by the food supply, but also by other, mostly weather-dependent factors. Similarly, the number of infections fluctuates considerably, with an overall upward trend. Most cases have so far been registered in the Swabian Alb, the Bavarian Forest, northern Bavaria and southern Hesse as well as in the Eifel region of North Rhine-Westphalia.



Bank vole

5.4. Mosquitoes: tropical diseases are still rare in Germany

Malaria and dengue fever are among the most dangerous diseases in the tropics. Mosquitoes transmit pathogens of these diseases and many others.

There is a growing fear that these diseases could also break out in Germany as temperatures continue to rise. But the dependencies are not that simple. Even though both the mosquitoes and the pathogens need certain minimum temperatures to survive, there are other factors that influence whether an infectious disease can establish itself in a region. For example, malaria, which used to be widespread in Europe as well, has almost disappeared, in part because swampy areas have been drained by changes in land use and mosquitoes have lost their breeding grounds. Better public health care has also helped to largely eradicate malaria in Europe. In isolated cases in Central Europe, mosquitoes infected with malaria have been brought on planes. In rare cases, people near airports contracted malaria.

Conversely, a pathogen can of course also be introduced into Germany, for example by returning tourists or infected animals. However, the disease can only spread if suitable hosts and vectors exist locally and climate conditions are favourable. Which is in fact the case in some places now.

Flooding caused by climate change will also increase, which could create new habitats for pathogen-transmitting mosquitoes.

In the recent past, West Nile Virus (WNV), which originally came from Africa, has managed to become established in Germany. It was imported by migratory birds, but it can also be transmitted to horses and humans by domestic mosquitoes (*Culex*). Long, hot summers increase the risk of West Nile infection, and it is assumed that the virus will continue to spread in Germany as a result of climate change.

German Protection against Infection Act

In 2016, an amendment to the German Protection against Infection Act (Infektionsschutzgesetz) introduced a mandatory requirement to report all viruses transmitted by arthropods (arboviruses). This makes rapid intervention possible and prevents the further spread of a disease or even an epidemic.

5.4.1. The Asian tiger mosquito

The Asian tiger mosquito can transmit many serious pathogens, including ZIKA, dengue and chikungunya fever. The tiger mosquito, which, unlike many other mosquitoes, is active during the day, owes its name to its black and white striped legs. The species has now spread to nearly every continent. Every spot where water accumulates, no matter how small, is enough for their larvae to thrive. International trade in used tyres has contributed to their global spread. Eggs that were laid in tyres in infested countries and dried up during transport can turn into larvae as soon as small amounts of water accumulate again in the tyres at the destination. The Asian tiger mosquito eggs also travelled as stowaways in the transport containers of "lucky bamboo" (*Dracaena sanderiana*) from Asia, which was imported to Europe and the USA.



Asian tiger mosquito – *Aedes albopictus*

The first tiger mosquitoes reached Europe in 1979 in a shipment of used tyres to Albania. In 1990 there was a downright invasion, which started from the port of Genoa and has since reached not only southern European countries like Spain, Greece and Montenegro, but also France, Germany and Switzerland. With regularly recurring dengue and chikungunya cases, for example in France, Croatia and Spain, this danger must be taken very seriously.

In the Mediterranean region, there are considerable populations of the Asian tiger mosquito today, which are constantly spreading further north. In 2007, people in northern Italy fell ill for the first time with chikungunya fever transmitted by tiger mosquitoes. A tourist had contracted the virus during a trip to India. About 200 people in and around Ravenna were gradually infected. The disease, until then completely unknown in the region, is accompanied by fever and severe joint and limb pain.

Asian tiger mosquitoes are being brought from southern countries to Germany in cars and lorries. Meanwhile, populations have gained a foothold in the federal states of Baden-Württemberg, Hesse and Thuringia (www.fli.de/de/kommissionen/nationale-expertenkommission-stechmuecken-als-uebertraeger-von-krankheitserregern/).

5.4.2. The Japanese bush mosquito

The Japanese bush mosquito used to be found only in Asia. However, it first appeared in the USA in 1998, and can now also be found in many parts of Europe. Due to the climate conditions, the mosquitoes also thrive in many parts of Germany. In 2009 and 2010 the Japanese bush mosquito was discovered for the first time in flower vases in cemeteries along the Swiss border. The arrival of the Japanese bush mosquito is particularly worrying because it is considered a carrier of various pathogens, including West Nile virus, which causes flu-like symptoms in humans. In rare cases, the disease can even be fatal.

An infection can be prevented with effective mosquito protection. This includes wearing long clothing, especially at times of day when mosquitoes are active, and applying repellents that protect against mosquitoes (see box *Better prevention* in section 5.2.2. *Tick-borne encephalitis (TBE)*).

Anyone can participate in the nationwide project of the Leibniz Center for Agricultural Landscape Research (ZALF) in Müncheberg and the Friedrich-Loeffler-Institute (FLI), Institute for Infection Medicine (Riems) (IMED) by catching and freezing mosquitoes and sending them to these institutions. They are creating a Mosquito Atlas, which maps the distribution of mosquitoes in Germany (for more information, see: <https://mueckenatlas.com/>).

6. Allergies

6.1 Climate change prolongs the pollen season

One of the most common causes of hay fever is pollen, and hay fever is already the most widespread allergic condition in Europe – and is on the rise. More than one million children and young people in Germany are currently affected. In addition, older people are increasingly likely to have a severe defensive reaction to the pollen of wind-pollinating trees such as hazel, birch and ash, grasses like timothy and herbs such as nettle, common mugwort and common ragweed. More and more people are suffering runny noses and watery eyes in spring, summer and autumn.

The situation will continue to get worse for several reasons: the pollen season is getting longer. In warm winters, the first hazel pollen sometimes appears as early as December, and three quarters of wild plants now start to bud earlier than they did a few decades ago. At the same time, the pollen season now ends later.



For further information, see:

Stiftung Deutscher Polleninformationsdienst

(<http://www.pollenstiftung.de/pollenvorhersage/pollenflug-kalender/>),

the brochure "Allergene im Garten" (www.bmu.de/WS4442) published by the Federal Environment Ministry

and the Allergy Information Service of the German government, which is overseen by the Helmholtz Zentrum München with support from the Federal Health Ministry as part of a research project

(<https://www.allergieinformationsdienst.de/>).

6.2 Ragweed: climate change helps its spread

When it comes to allergies, medical professionals are particularly concerned about ragweed – its Latin name is *Ambrosia artemisiifolia*. The annual weed can bloom from July until October and is considered highly allergenic. A single plant produces as many as three billion pollen grains. As few as ten can be enough to cause symptoms in people with allergies.

Indigenous to North America, ragweed was first brought to southeastern Europe, where it is now widespread. It made its way to Germany in contaminated seeds and birdseed.

There is currently a ragweed hotspot in the southeast of the state of Brandenburg, but large concentrations of ragweed plants (more than 100) can now also be found in other regions of Germany. It is particularly at home on rubble heaps, fallow areas, railway embankments and along roadsides. Ragweed seeds are often transported by lorry in excavated soil from construction sites to new places where it can grow again. It also often grows in gardens near bird feeders because the bird food was contaminated with ragweed seeds. When buying birdseed, it is important to make sure that it does not contain ragweed seeds. Since 2011, an EU regulation stipulates that animal feed may generally only contain a maximum of 50 mg ragweed seeds per kilogram of feed.

In general, and also for ragweed, it is true that pollen can make people ill regardless of whether it comes from nearby or far away. This is because pollen can be transported over long distances by air currents (called long-distance transport).



Ambrosia artemisiifolia

Ragweed – pull out the roots and stem

Ragweed plants should be removed before they flower in July. Wear gloves because the bristly leaves and stems can cause skin irritation in many people. It is also important to remove the root as well, otherwise the weed can reappear. If the plant is flowering, wear a mask in addition to gloves to protect against dust.

Allergy sufferers should avoid all contact with the plant. Ragweed must be disposed of in the bin, not on the compost pile. The places it was found should be checked again at a later time. This is even more important if the plant had already formed seeds because they can germinate for up to 40 years.

Several federal states in Germany have set up offices to report places where ragweed has been found.

www.ambrosia.de/ambrosia-meldestellen.html

6.3 Animal hair allergies – a hairy contemporary benefits from climate change



Oak processionary moths

Since the mid-1990s, mild winters and dry summers have led to a rapid spread of the oak processionary moth, a moth species native to Germany. The caterpillars of the moth make their way to the fresh green leaves in the treetops in long rows in spring, hence their name. They infest oak trees in forests and cities.

They prefer sunny, free-standing trees and often strip trees bare of new leaf shoots.

The caterpillar is protected from predators by stinging hairs, which can cause severe allergic, sometimes inflammatory skin and mucous membrane reactions in humans and animals.

The barbed stinging hairs of the oak processionary moth can directly irritate the skin or mucous membranes, causing itchy rashes, conjunctivitis or a defensive reaction of the respiratory mucosa. But the stinging hairs also have a protein-based toxin that can cause allergic reactions, discomfort and fever or even allergic shock in humans. And these reactions can even be triggered without coming into direct contact with the caterpillars as the dangerous stinging hairs also travel through the air. In the particularly hot summers of 2003 and 2006, the oak processionary moth experienced massive reproduction. It feels especially at home in free-standing trees. Not only are local residents and passers-by at particular risk, but also, for example, forestry workers and children from nearby schools and daycare centres.

Other hairy caterpillars have also been spotted more frequently in Germany in recent years. The pine processionary moth infests – as its name suggests – pine trees. The gypsy moth is found in many deciduous trees, but especially in lime and oak trees. The rusty tussock moth looks for leafy bush- and hedge-shaped shrubs. Their hairs can also cause inflammatory and allergic reactions.

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