Europe's health in a changing climate

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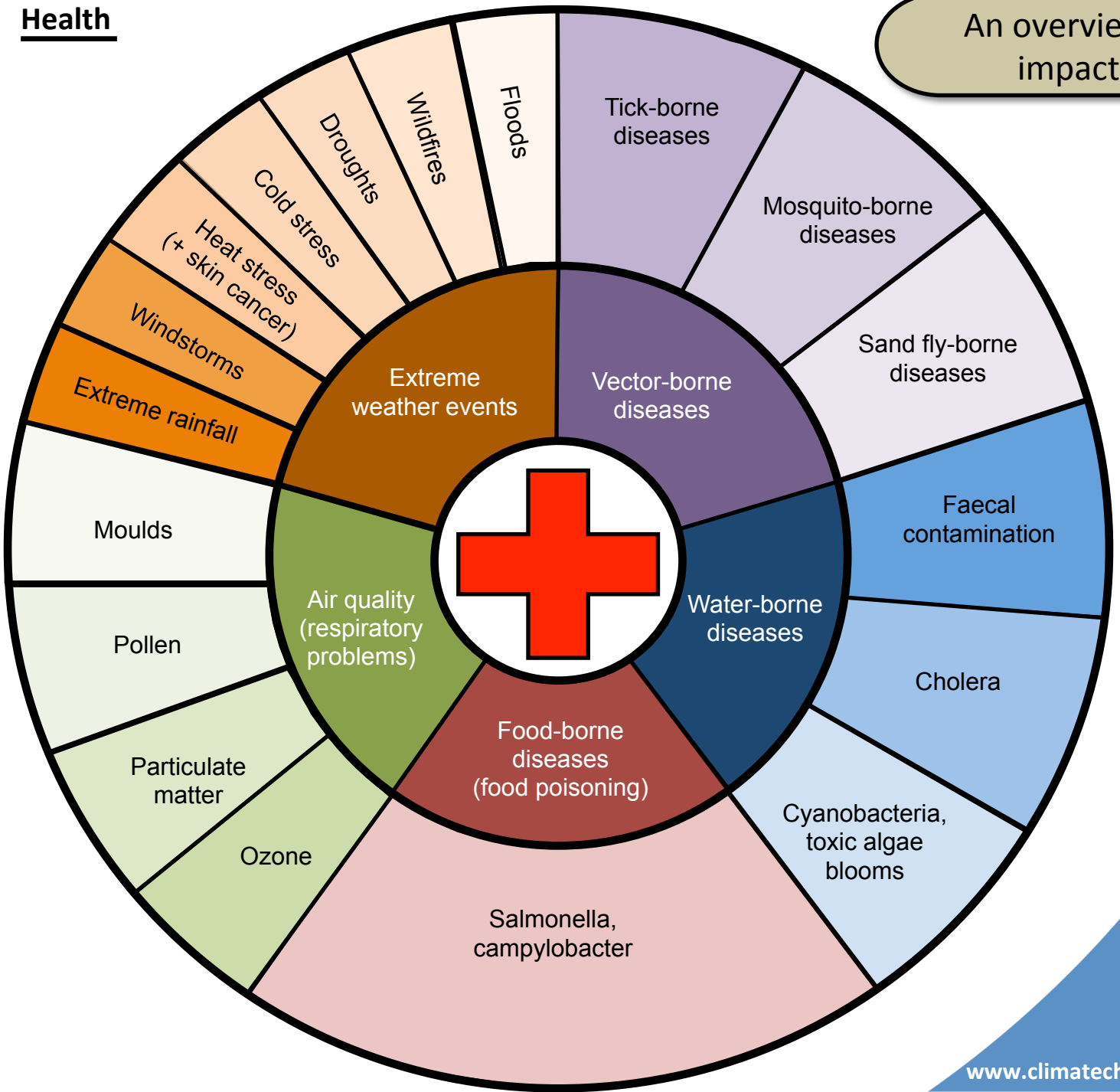
Health

An overview of impacts



Health

Extreme weather events

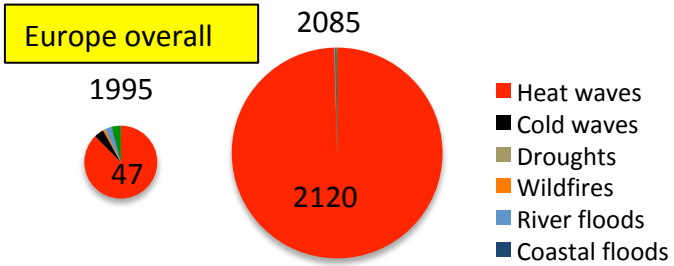
Europe overall:
Dominant impact heat stress

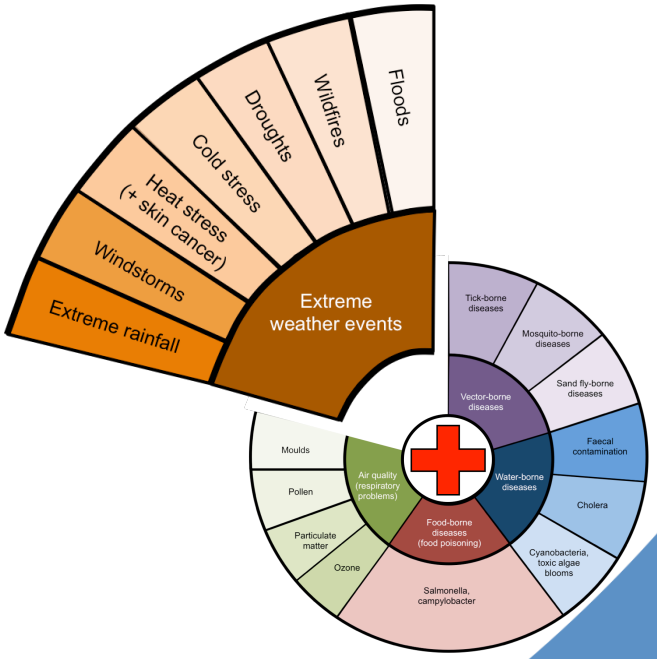
What if we don't take additional measures to enhance our capacity to cope with future extreme climate conditions?

Studies show that the number of weather-related fatalities may strongly increase.

Increase: population change accounts for 10%, climate change for the remaining 90%.

The number of weather-related fatalities per 10 million inhabitants in 1995 and 2085 (projection) (*source data: Forzieri et al., 2017*):





Heat-related mortality dominates weather-related fatalities.

Health

Extreme weather events

Europe overall:
Dominant impact heat stress

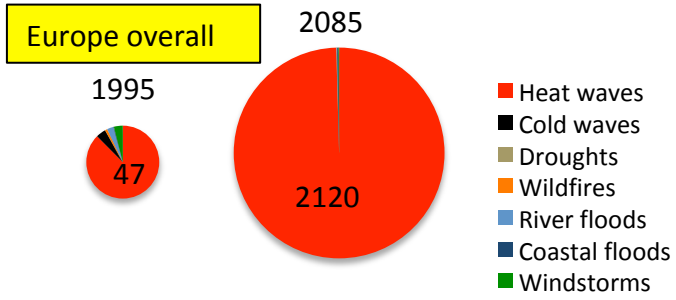
A very strong increase heat-related mortality. Reliable projection?

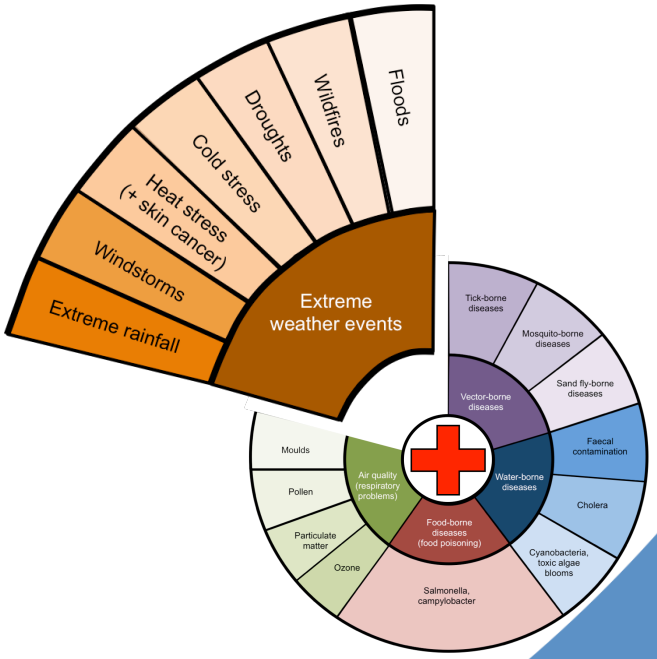
For comparison:
Almost 36,000 and 86,000 net extra deaths per year by the 2080s under a global mean temperature increase of 2.2°C and 3°C, respectively, when people do not acclimatise to higher temperatures (PESETA project, 2007).

For comparison:
- 44,000 extra heat-related deaths during the 2003 heat wave in Western Europe (70,000 in all of Europe)
- 50,000 – 55,000 extra heat-related deaths during the 2010 heat wave in Europe (especially Russia).

Same order of magnitude!

The number of weather-related fatalities per 10 million inhabitants in 1995 and 2085 (projection) (*source data: Forzieri et al., 2017*):





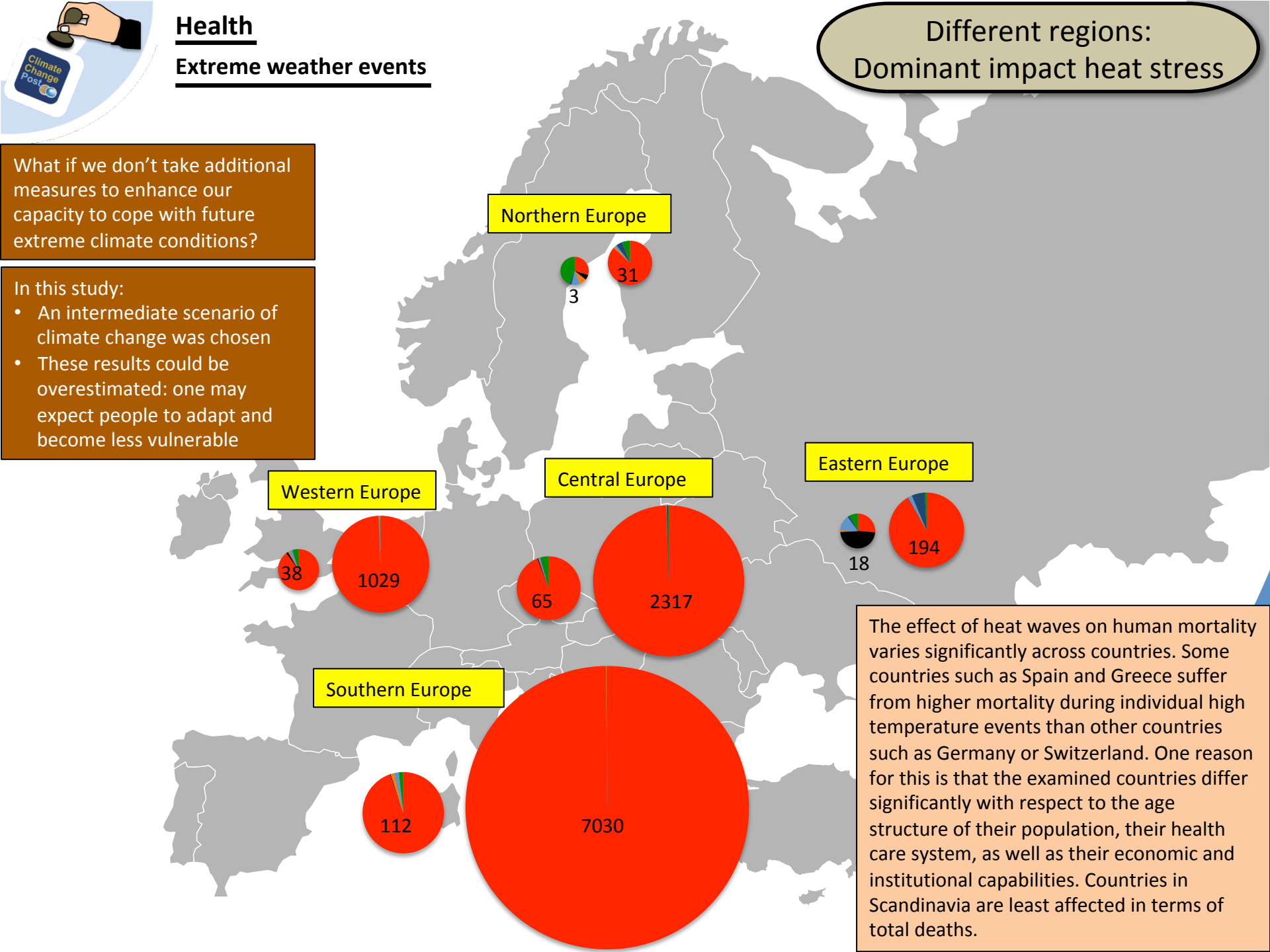
Health

Extreme weather events

What if we don't take additional measures to enhance our capacity to cope with future extreme climate conditions?

In this study:

- An intermediate scenario of climate change was chosen
- These results could be overestimated: one may expect people to adapt and become less vulnerable



The effect of heat waves on human mortality varies significantly across countries. Some countries such as Spain and Greece suffer from higher mortality during individual high temperature events than other countries such as Germany or Switzerland. One reason for this is that the examined countries differ significantly with respect to the age structure of their population, their health care system, as well as their economic and institutional capabilities. Countries in Scandinavia are least affected in terms of total deaths.

Health

Extreme weather events

2100

Heat waves

Urbanisation and urban heat island effects will augment the effects of heat waves

Studies:
Heat waves most lethal: account for 99% of total future disaster-related mortality

Strong gradient North - South

At the end of this century, about a third of the population in Northern Europe and almost all of those in Southern Europe could be exposed to a weather-related hazard annually

Health

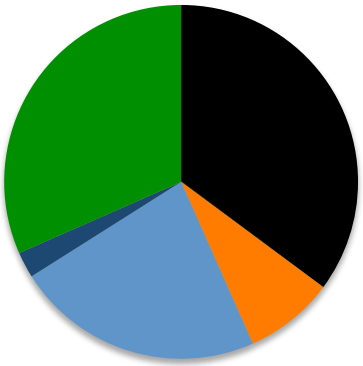
Extreme weather events

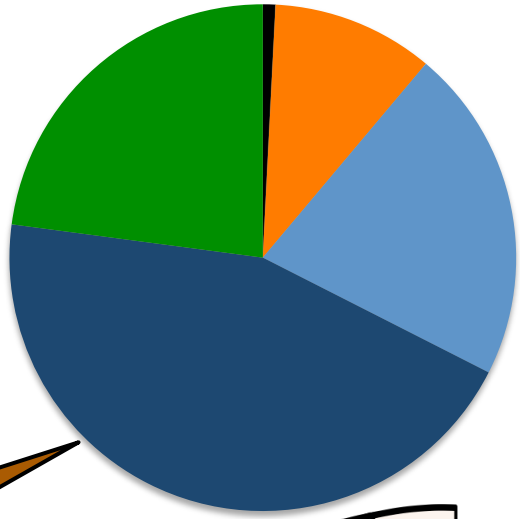
What if we omit heat stress?

Europe overall

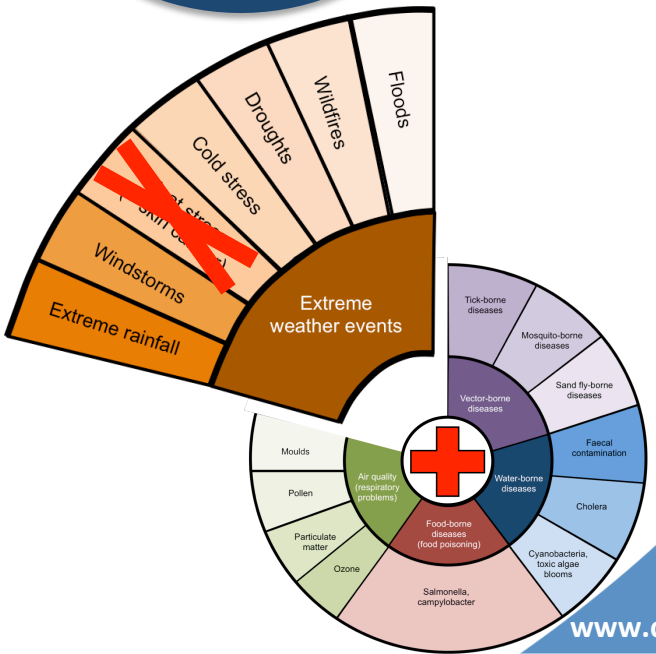
1995:
6 fatalities per 10 million

2085:
9 fatalities per 10 million





Mortalities due to coastal floods are expected to increase by 3780%, due to wild fires by 138%, due to river floods by 54%, and due to windstorms by 20%, whereas mortality due to cold waves is projected to decrease by 98%. The effects of coastal flooding will be amplified by population growth in coastal flood-prone areas.



Number of weather-related fatalities per 10 million inhabitants in 1995 and 2085 (projection) (*source data: Forzieri et al., 2017*)

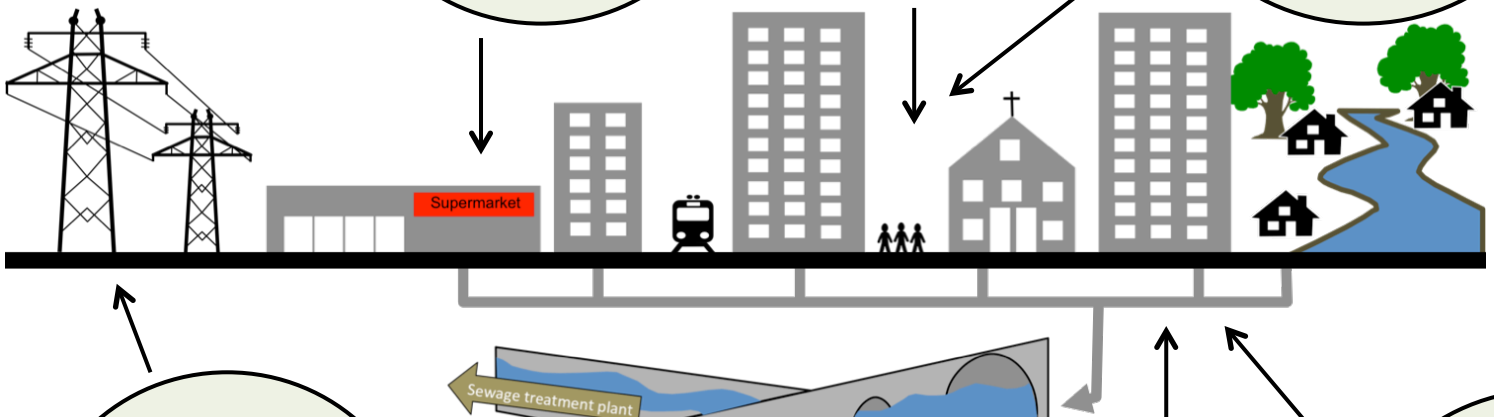
Health

Vulnerabilities in cities

Far-flung supply lines combined with just-in-time shipping practices can result in shortages of needed goods when transportation is disrupted by extreme weather

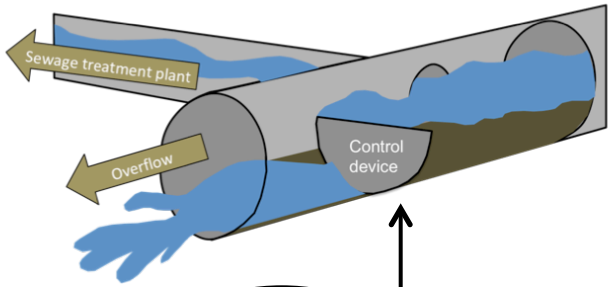
The concentration of people in urban centres puts pressure on vegetation and green spaces that could reduce heat, storm water runoff, pollution and social pressures

The concentration of people in large cities creates a large demand for water and can strain local water supplies, making them more susceptible to water shortages in drought conditions. Homeless people are particularly vulnerable



Urban sprawl and competition for building sites has led to construction in locations such as floodplains or steep slopes that are vulnerable to extreme weather

Centralized power sources, longer distribution lines, and an increasingly interconnected grid increases vulnerability to blackouts (during heat wave or storms, for example)



Combined sewers that carry both storm water and sewage are common in many cities. Intense precipitation leads to overflows in these sewer systems, washing untreated pollutants into local water bodies

Asphalt, concrete and other hard surfaces in the city absorb radiation from the sun, causing the urban heat island effect, which exacerbates heat waves

Hard surfaces also prevent absorption of rainfall, creating runoff that carries pollution to lakes and streams and can overwhelm storm water systems, leading to sewer backups and flooding during heavy precipitation events

Health

Extreme weather events

Present

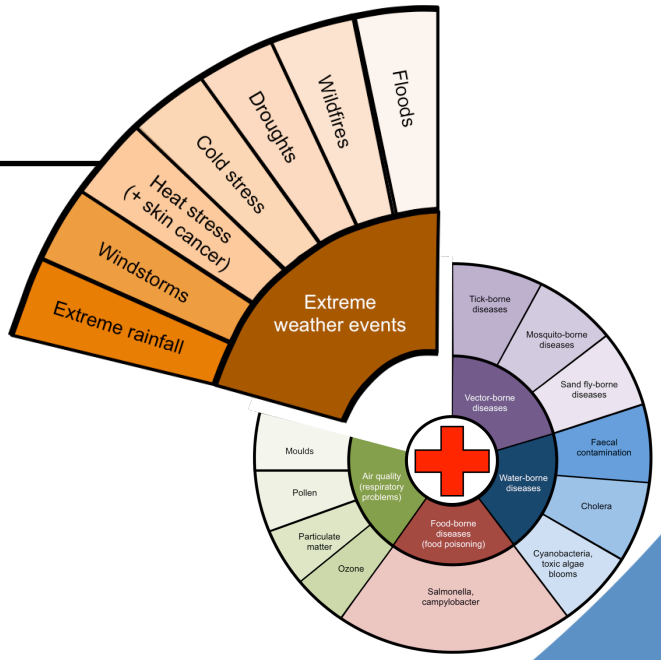
Heat stress: excess mortality

On average, around 28,000 people die every year in all countries of the EU combined due to heat waves. An average of 0.61% of all mortality in these countries is excess mortality caused by heat waves. This estimate goes up to 1.14% in the worst affected country, Portugal.

The impact is worst for the cities due to the urban heat island effect. This effect was up to 3°C in the summer during daytime values in Europe's cities over the period 2006-2011. The effect may be higher during the night. Global warming will probably increase this urban heat island effect.

The experience of 2003 shows that those most likely to die of the heat are the old, the chronically ill, and the isolated.

After a heat wave the mortality drops below the average. This phenomenon is called the „harvesting effect": a part of the heat victims refers to people who would have died a few days later anyway, without a heat wave. Still, a part of the victims are people that would not have died otherwise: thus, a heat wave results in a higher mortality over a long period of time.



Health

Extreme weather events

Past

Heat stress

Results adjusted for urbanization and heat island effects show that in Sweden there was a small increase in extreme cold temperature-related mortality and a substantial increase in extreme heat temperature-related mortality in 1980-2009 as compared with 1900-1929.

As a result of the heat and the wildfires in Russia in 2010 the daily mortality rate in Moscow alone jumped from 360-380 people in July 2009 to 700 people in July 2010 (5,840 total monthly increase). Around 14,000 deaths resulted from the summer heat, with half of them in and around Moscow alone. Another estimate is a death toll of 55,000.

In the UK there was a progressive reduction in the number of temperature-related deaths over the 20th century, despite an aging population. This trend is likely to reflect improvements in social, environmental, behavioral, and health-care factors.

In August 2003, France was hit by a severe heat-wave that led to an excess of almost 15,000 deaths in France, between August 4 and 18. For the whole of summer 2003, the number of heat related deaths in Western Europe is believed to amount to over 44,000.

Without anthropogenic climate change the 2003-like mortality would have been a 1-in-300-year event for Paris and a 1-in-7-year event for London. Due to climate change this return level has increased to a 1-in-70-year event for Paris and a 1-in-2.5-year event for London.

Health

Extreme weather events

Heat stress versus cold stress

The impact of climate change on heat- and cold-related mortality varies within Europe and from one part of a country to another.

During the heat wave of 2003, the centre of London was up to 10°C warmer than the surrounding greenbelt. Heat mortality was greatest in the London region.

Europe: net increase mortality

Europe:
Climate change is projected to increase heat-related mortality and decrease cold-related mortality, with an overall net increase in total mortality rates.

UK: net decrease mortality

United Kingdom (medium-high climate change scenario):

- annual cold-related deaths are expected to decrease from about 80,300 in the 1990s to about 60,000 in the 2050s and 51,200 in the 2080s
- annual heat-related deaths are expected to increase from about 800 in the 1990s to about 2800 in the 2050s and about 3500 in the 2080s

London: higher mortality than elsewhere in the UK

London (period 2001-2010):
Odds of dying from cardiorespiratory causes increased by more than 10% for 1°C warmer temperature in the most vulnerable districts of England and Wales, those in London and south/ southeast England, compared with virtually no effect in the most resilient districts in the far north.

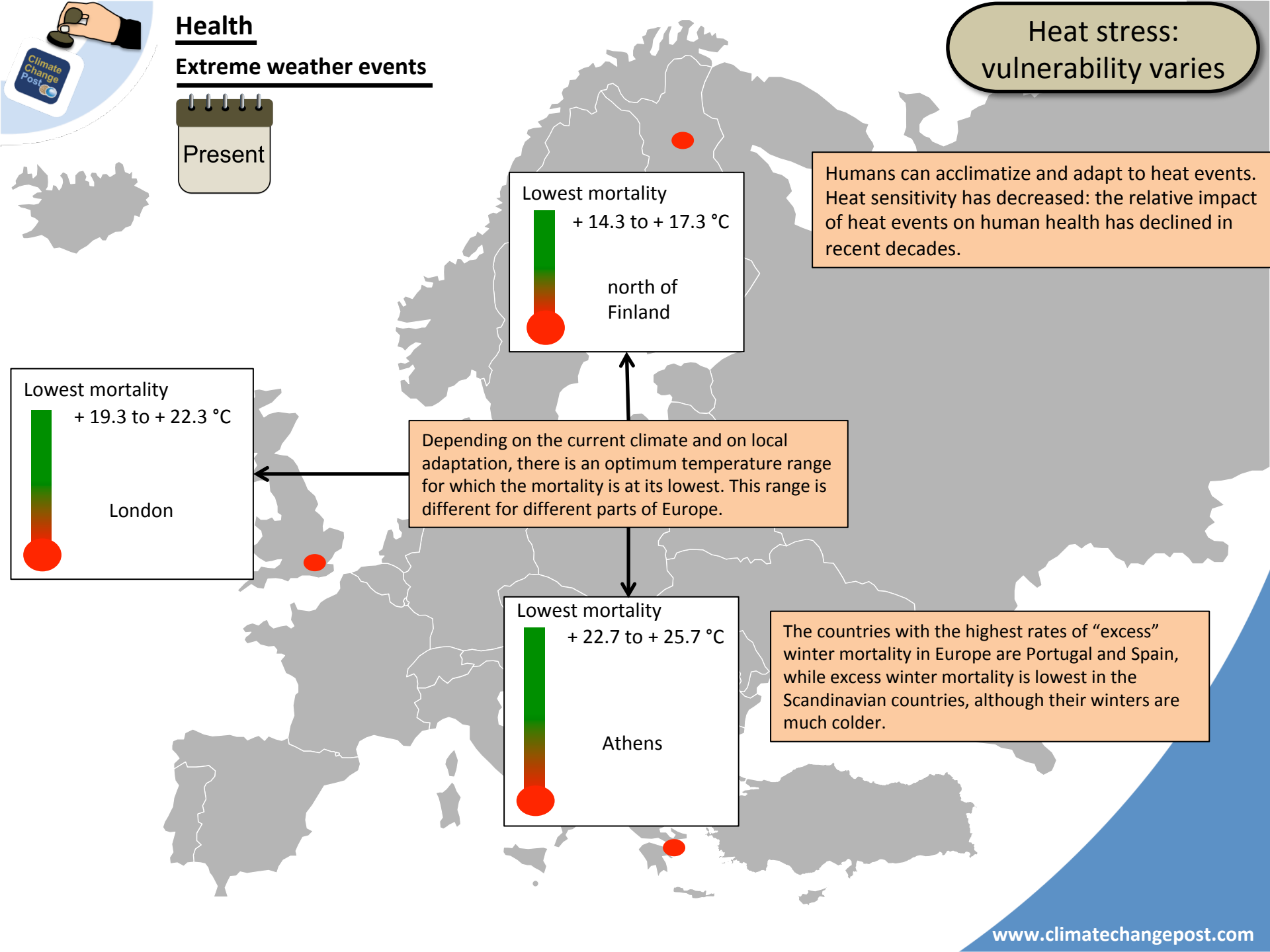
Health

Extreme weather events

Present

Heat stress: vulnerability varies

Humans can acclimatize and adapt to heat events. Heat sensitivity has decreased: the relative impact of heat events on human health has declined in recent decades.



The countries with the highest rates of “excess” winter mortality in Europe are Portugal and Spain, while excess winter mortality is lowest in the Scandinavian countries, although their winters are much colder.

Health

Extreme weather events

2100

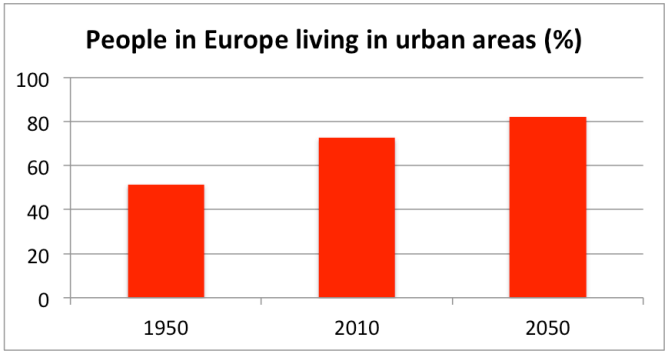
Heat stress

Exposure to extreme hot and humid conditions will rapidly increase throughout the 21st century. By 2080 the relative frequency of these present-day extreme events could rise by a factor of 100-250 in the tropics and parts of the mid-latitudes, under a moderate and high-end scenario of climate change. In addition, population exposure to extreme conditions that exceed recent deadly heat waves may increase by a factor of five to ten.

Strong increase heat exposure

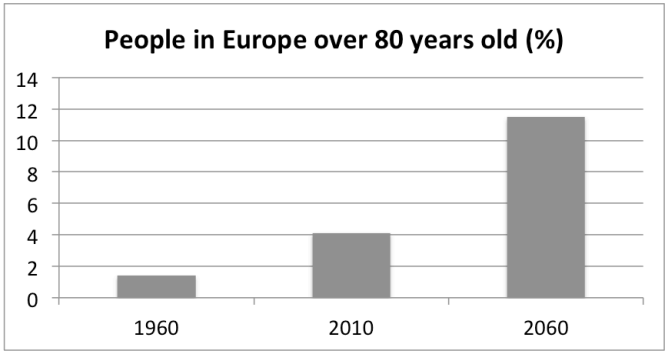
Stronger impact urban heat island

It is expected that the mortality in the summer will increase substantially because of climate change. Not only high temperatures during the day but also during the night are important. Especially in cities the nights will cool less during the summers because of the urban heat island effect. Probably, in the future more people will live in big cities. Thus, more people are subject to higher temperatures. With climate change, the problem of urban heat islands will increase.



Strong increase vulnerability

Future changes in the frequency and intensity of heat waves might be of a magnitude large enough to overwhelm the ability of individuals and communities to adapt. The expected increase in the number of elderly and other potentially vulnerable groups, in absolute numbers and as a proportion of the population, could make the impact of temperature extremes on human health even more severe.



Health

Extreme weather events

Adaptation strategies to combat heat stress: an overview

In order to combat overheating of London, the city council intends to plant two million trees and lay out 'pocket parks' in the inner city. This will result in an increase of green area by 5% in the next 20 years. The council aims for an increase of one third before 2050.

Research has shown that relatively simple adaptation strategies such as early warning of heat waves, public education campaigns on the dangers of heat, and social check-ups on vulnerable people can drastically reduce the death toll on hot days.

The relatively weak mortality response of the 2003 heat waves in the Czech Republic compared to previous heat waves in the 1990s is also likely to have arisen from positive health-care and other socio-economic changes in the post-communist central European region over the past decade, as well as a better public awareness of heat-related risks due to enhanced media coverage and regular biometeorological forecast and warnings.

- Greening measures (trees along streets and open spaces, green-roofed buildings)
- Measures on buildings, road infrastructures, and urban morphology, including more heat-reflective surfaces, thermal insulation, solar protection via shutters, ventilation, and choosing an appropriate geometry and size of buildings and street areas
- Measures to increase the soil's moisture which helps to reduce the temperature
- Heat-health warning systems and heat wave plans
- Organise responsibility for populations that are fragile (elderly, children). During the hot period of the year, provide public transport, work places, hospital areas, institutions for disabled people with air coolers, ventilation systems and medical kits.
- Provide family doctors and ambulances with diagnostic equipment and medical aid kits in case of serious climatic events.
- Improve preventive treatments for people sensitive to climate conditions in order to diminish the negative impact of extreme climate conditions.
- Make buildings with air conditioning available to the public during hot spells as a refuge from high temperatures.

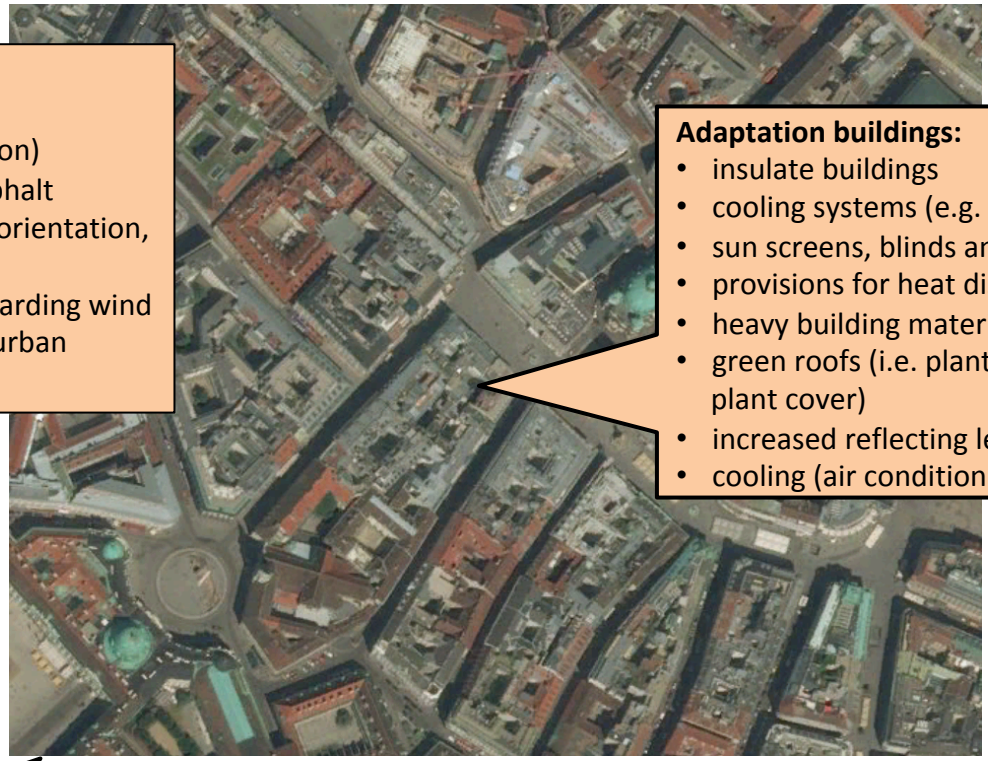
Health

Extreme weather events

Adaptation strategies to combat heat stress: the living environment

Adaptation cities:

- open water and fountains
- vegetation (cooling due to evaporation)
- high albedo pavement instead of asphalt
- creating optimal shading in building orientation, compact building and (big leaf) trees
- orientation and profile of streets regarding wind direction (affecting wind speed and urban ventilation)



Adaptation buildings:

- insulate buildings
- cooling systems (e.g. heat pumps)
- sun screens, blinds and shutters
- provisions for heat disposal (e.g. chimneys)
- heavy building materials (high solar thermal mass)
- green roofs (i.e. plant cover); green facades (i.e. plant cover)
- increased reflecting levels of roofs (albedo)
- cooling (air conditioning)

Vienna (Austria) as an example:

Cooling potential blue and green infrastructure:

- The combination of a decrease in building density by 10% and pavement by 20%, enlargement in green and water spaces by 20% has a substantial cooling effect.
- By concentrating the parks in the city centre, the cooling effect could be amplified as compared to locating parks in the low-density residential areas in the outer districts of the city.
- Applying high reflectivity materials leads to average cooling in densely built-up area of approximately 0.5 °C. Green roofs yield a heat load reduction in similar order of magnitude as the high reflectivity materials.

Warning:
blue infrastructure has negative effects

- Open water bodies in the city cool the environment during the day but warm it at night, especially in summer when cooling is most needed. In fact, the advection of warm air from adjacent water bodies at night may enhance the urban heat island effect.

Health

Extreme weather events

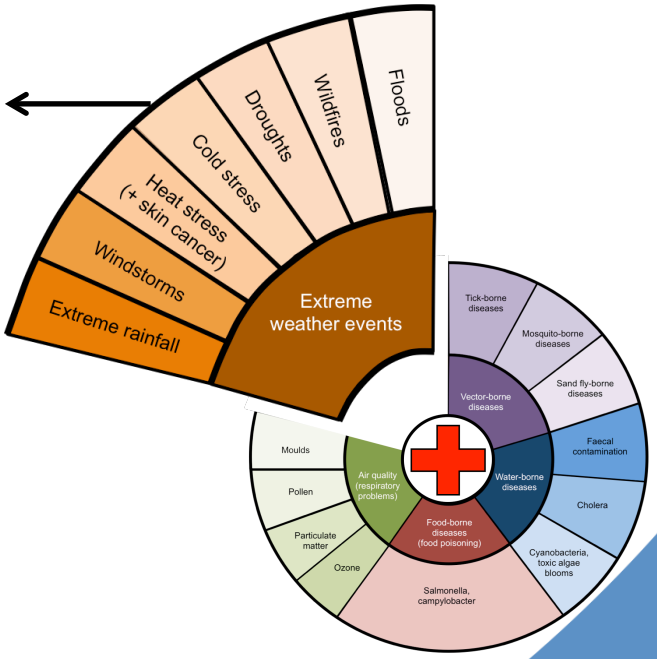
Present

Cold stress

Winter-related mortality in many European populations has declined since the 1950s. Cold days, cold nights and frost days have become rarer, but explain only a small part of this reduction: improved home heating, better general health and improved prevention and treatment of winter infections have played a more significant role.

For Romania a strong increase in the frequency of extremely high values for summer thermal stress, and a decreased risk of winter wind chill on human health was found during the period 1962-2010.

However, how harsh a winter is no longer predicts how many excess deaths there will be. In fact, the absolute number of excess deaths may increase in the coming decades due to an increase in future winter temperature volatility and because of a growing and ageing population.



Health

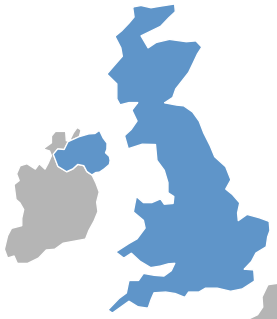
Extreme weather events

2100

Cold stress: a few examples

Fewer colder days associated with winter warming may have several positive health impacts for Iceland.

In countries like Finland, mortality will probably decrease as the mean temperature increases. The reason for this is that the mortality minimum in Finland is reached at approximately 14 degrees Celsius, excess mortality is significantly higher in extremely cold temperatures than during periods of intense heat, and extremely cold temperatures are estimated to become less common.



It is estimated that the number of deaths per year in Sweden in heat waves will have increased by just over 1,000 by the end of this century. The decrease in the number of really cold days results in reduced mortality, but this effect is smaller.

In the United Kingdom, annual cold-related deaths are expected to decrease faster than annual heat-related deaths will increase.

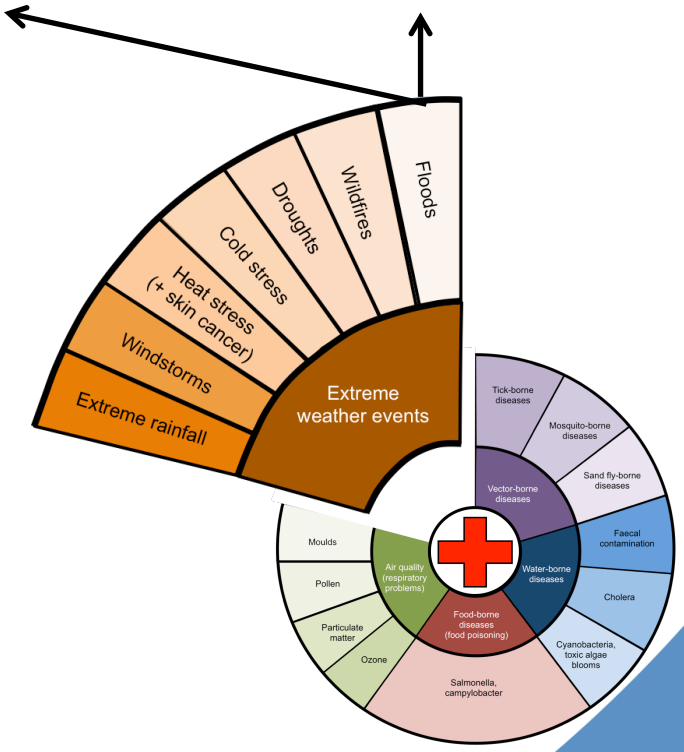
Health

Extreme weather events

Floods

Human health consequences of flooding include drowning, injuries, and an increased incidence of common mental disorders. Anxiety and depression may last for months and possibly even years after the flood event and so the true health burden is rarely appreciated.

There are health issues arising from the leaching of wastes from older landfill sites due to a rising water table and from intense rainfall. Also, there are potentially critical issues arising from more flooding of old mine workings generating flows of contaminated water into waterways.



Health

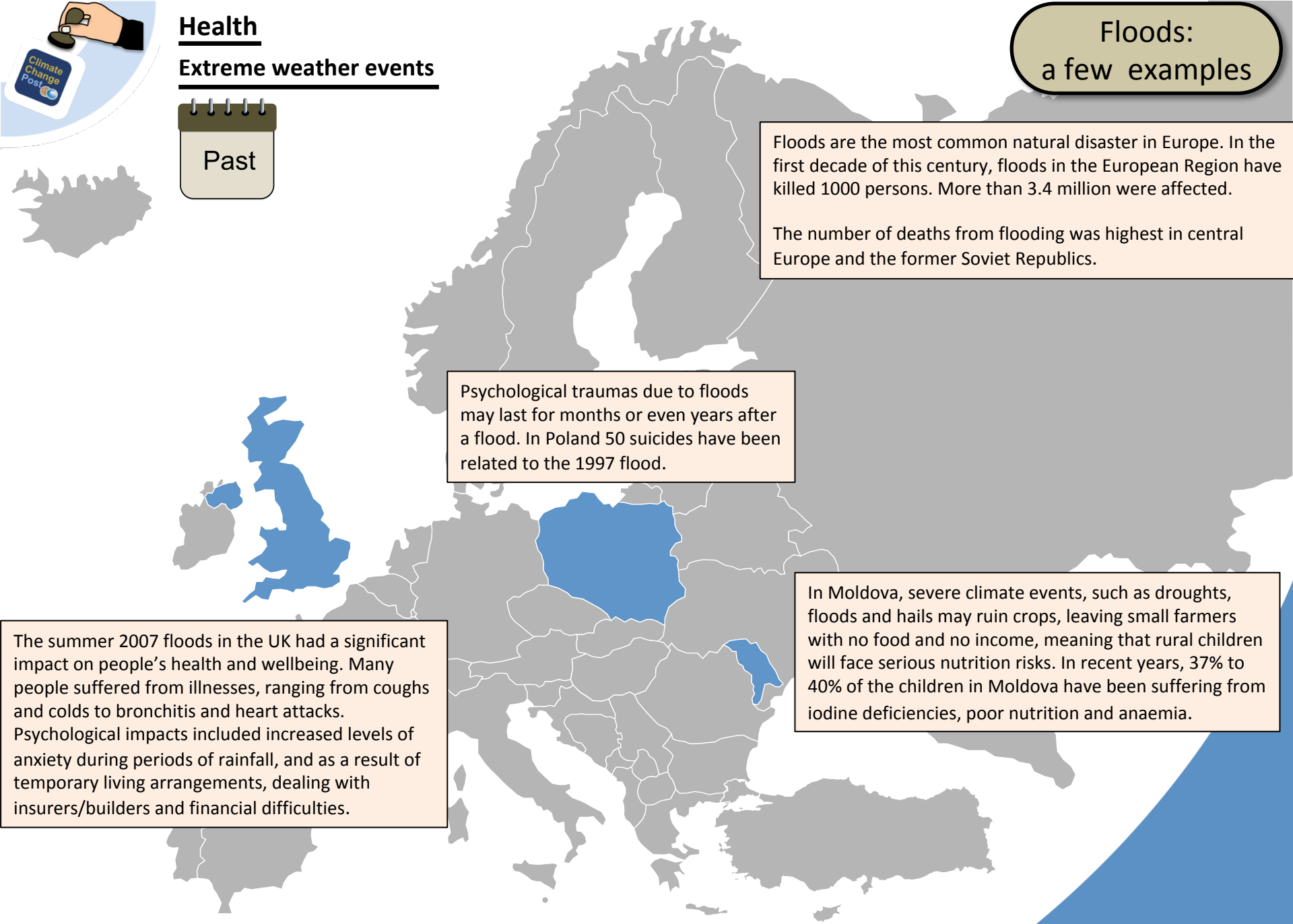
Extreme weather events

Past

Floods: a few examples

Floods are the most common natural disaster in Europe. In the first decade of this century, floods in the European Region have killed 1000 persons. More than 3.4 million were affected.

The number of deaths from flooding was highest in central Europe and the former Soviet Republics.



Psychological traumas due to floods may last for months or even years after a flood. In Poland 50 suicides have been related to the 1997 flood.

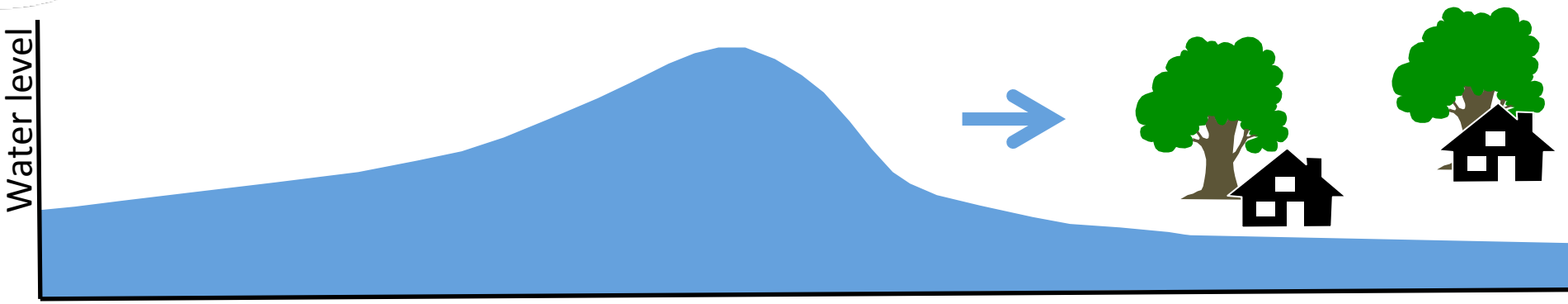
In Moldova, severe climate events, such as droughts, floods and hails may ruin crops, leaving small farmers with no food and no income, meaning that rural children will face serious nutrition risks. In recent years, 37% to 40% of the children in Moldova have been suffering from iodine deficiencies, poor nutrition and anaemia.

The summer 2007 floods in the UK had a significant impact on people's health and wellbeing. Many people suffered from illnesses, ranging from coughs and colds to bronchitis and heart attacks. Psychological impacts included increased levels of anxiety during periods of rainfall, and as a result of temporary living arrangements, dealing with insurers/builders and financial difficulties.

Health

Extreme weather events

Adaptation strategies for health protection related to floods



After the flood:

- Post-flood counselling (for anxiety and depression, for example)

During the flood:

- Prevention and treatment of respiratory problems, infectious diseases, injuries, mental health problems and skin and eye diseases
- Possible extra vaccinations for the general population
- Distribution of “boil water” notices, general hygiene advice and information on preventing mould, snake bites and electrocution
- Outbreak investigation where appropriate
- Enhanced health surveillance
- Water and food provision
- Treatment for mould and other pathogenic exposures

Before the flood:

- Long-term risk management: flood health prevention as part of multipurpose planning
- Inter-institutional coordination
- Infrastructure flood-proofing
- Risk mapping of health care and social care facilities, availability of communication and transport possibilities;
- Emergency medical service preparedness, water and food supply planning for emergencies, evacuation organization
- Awareness-raising campaigns targeting different groups in areas at risk

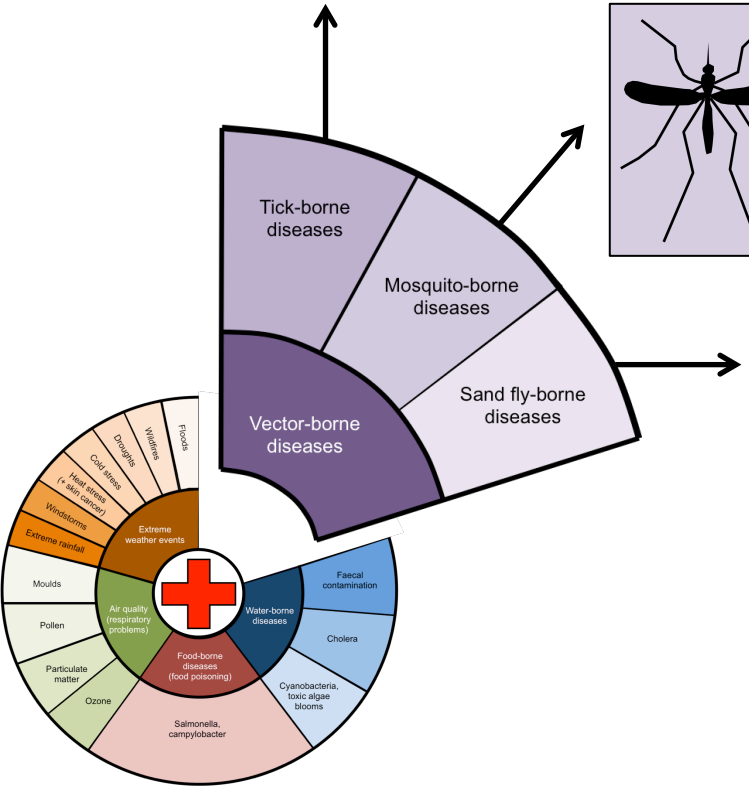
Health

Vector-borne diseases

Present

Tick-borne diseases

Lyme disease is the most important vector-borne disease in temperate zones of the northern hemisphere in terms of number of cases. The number of cases in Europe has increased steadily: at least 85,000 cases are reported every year and prevalence is greater eastwards. Its geographical distribution is still increasing, especially towards higher altitudes and latitudes. Lyme disease is caused by the *Borrelia* bacteria. The tick that transmits this bacteria occurs throughout Europe: the overall mean prevalence of the *Borrelia* bacteria in these tick is 13.7%.



Since 1990, malaria has been observed in parts of Europe (southern Europe, parts of the former Soviet Union, Turkey). These outbursts are probably not related to climate change, but are due to a deterioration of socio-economic and health circumstances, global tourism and an increasing resistance of the mosquitoes against vaccines.

Leishmaniasis is a parasitic infection transmitted to human beings through the bite of an infected female sand fly. Sand fly distribution in Europe is south of latitude 45°N and less than 800 m above sea level.

Health

Vector-borne diseases

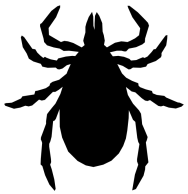
Present

Tick-borne diseases

Increase not just result of climate change

The increase in the number of tick-borne diseases is not necessarily due to climate change. The increasing popularity of outdoor recreation is believed to be one of the most important causes of the increase of the number of cases of Lyme disease.

In the Alps and Scandinavia increased winter mean temperatures at higher altitudes and latitudes and an extended vegetation period may have permitted roe deer to spread to and inhabit previously inhospitable areas. Such deer movements may have allowed disease-transmitting ticks to be transported northwards on the Scandinavian Peninsula, resulting in a significantly increased tick range.



In the future, the distribution of disease-transmitting ticks is projected to expand in Northern Europe as winter seasons become shorter and milder, and deciduous woodland expands. Tick density and infection risk will probably also increase due to an increase in the density of wild and domestic vertebrates, paralleled with the expansion of suitable habitats for the host animals of ticks.

The upsurge of encephalitis in the 1980-90s in Central and Eastern Europe generally has been attributed to socio-economic factors (human behavior) rather than temperature.

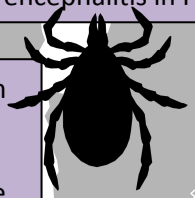
Health

Vector-borne diseases

Present

A few examples

There is some evidence of northward migration of Lyme disease and tick-borne encephalitis in Finland.

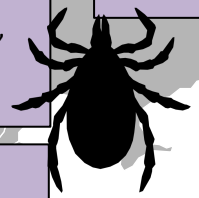


Between the early 1980s and mid-1990s in Sweden a northward expansion of the geographic distribution limit of disease-transmitting ticks, an increased tick density and an increase in tick-borne encephalitis incidence has been reported.

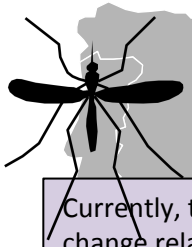
As many as 250,000 Russians suffer from latent, local forms of malaria. West Nile and Dengue Fever are reported to be spreading across the country as well. Climate change impact on the frequency of malaria cases has already become obvious for some regions. Thus, in Moscow region the malaria epidemiological situation has already been transformed. Due to several epidemiological seasons with abnormally early high daily average temperatures the number of malaria cases has rapidly increased.

Tick encephalitis, Lyme disease, and tick rickettsiosis (Rocky Mountain Spotted Fever) are three of the diseases that are spreading increasingly aggressively across Russia.

Lyme disease is prevalent in Bosnia and Herzegovina, Serbia, and Montenegro. Countries with annual incidences of over 20 per 100,000 include Lithuania, Estonia, Slovenia, Bulgaria, and the Czech Republic.



In 1993 the incidence of tick-borne encephalitis showed a sharp rise in central Europe and has remained high since.



Currently, the most important climate change related vector-borne diseases of concern in Malta are Chikungunya fever and Dengue fever.

Health

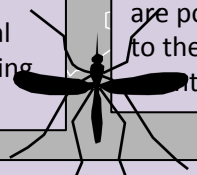
Vector-borne diseases

2100

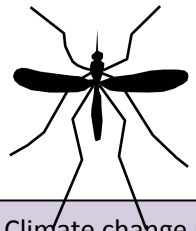
A few examples

The risk of a potential spread of malaria in Europe is very low under current socio-economic conditions, but some Eastern European countries might be at risk. In Eastern European countries, where per-capita health expenditure is relatively low, health services are less efficient in detecting and treating malaria cases, and the environmental measures to control mosquito distribution are poorly implemented. This could eventually contribute to the uncontrolled spread of the disease in these countries.

A milder climate could result in the "Asian tiger mosquito", a proved viral vector causing Dengue fever, becoming established in Germany.



In addition to West Nile fever, the population of Vojvodina and south Serbia might be exposed to the risks of malaria, Rift Valley fever, Chikungunya fever, dengue fever, leishmaniasis and other vector-borne diseases.



Climate change may lead to the entry of sub-tropical diseases so far unknown in Spain such as dengue, Rift Valley fever and malaria.

Leishmaniasis infections may spread to northern latitudes. Conversely, if climatic conditions become too hot and dry for vector survival, the disease may disappear in southern latitudes.

Health

Vector-borne diseases

Adaptation strategies

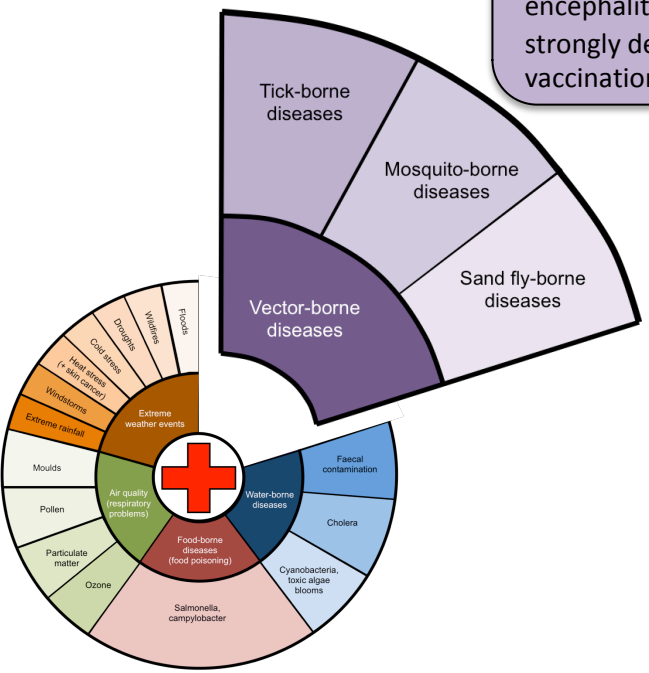
Education of the public is generally seen as an effective means to prevent a further spreading of ticks and malaria in the context of climate change.

- On-going monitoring and surveillance programs
- Collaboration with veterinary sector and management of animal disease outbreaks
- National monitoring and control of climate-sensitive infectious diseases (early detection and warning)
- Health services during an infectious disease outbreak and diagnostic support during an epidemic
- Educational programs for individuals, communities, and health care workers on identifying and treating diseases
- Spraying to control infestations; control of other factors that support the expansion of disease-carrying insects (e.g. standing water)

Austria is among the most strongly affected countries in Central Europe, but the annual number of encephalitis cases has strongly declined due to vaccination.

- Early-warning system for tick activity and disease risk
- Preventing tick bites, by avoiding tick risk areas, being informed about how to remove ticks and recognize early symptoms, using insect repellent on skin and clothing when in risk areas, and wearing protective clothing with long sleeves, and long trousers tucked into socks or boots
- Vaccination against encephalitis

There is currently no vaccine available on the European market for Lyme disease.



Health

Water-borne diseases

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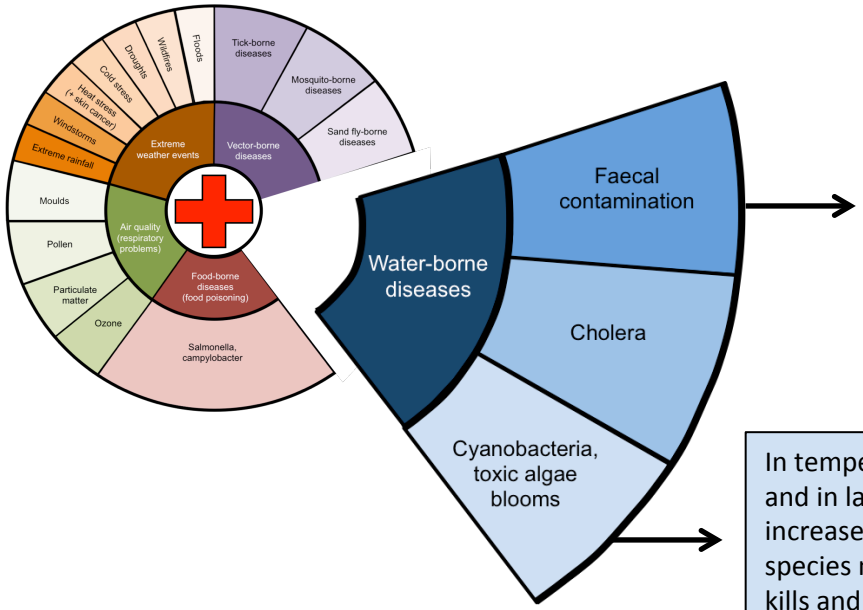
Overview

Climate change may affect the number of water-borne diseases through more intense rainfall, floods, and higher temperatures. In industrialized countries, epidemics after floods have not been observed. Higher temperatures have an effect on the number of illnesses through certain types of algae and Cyanobacteria. In general, drinking water quality is not expected to suffer so much from climate change in Europe as to have an effect on the spread of water-borne diseases.



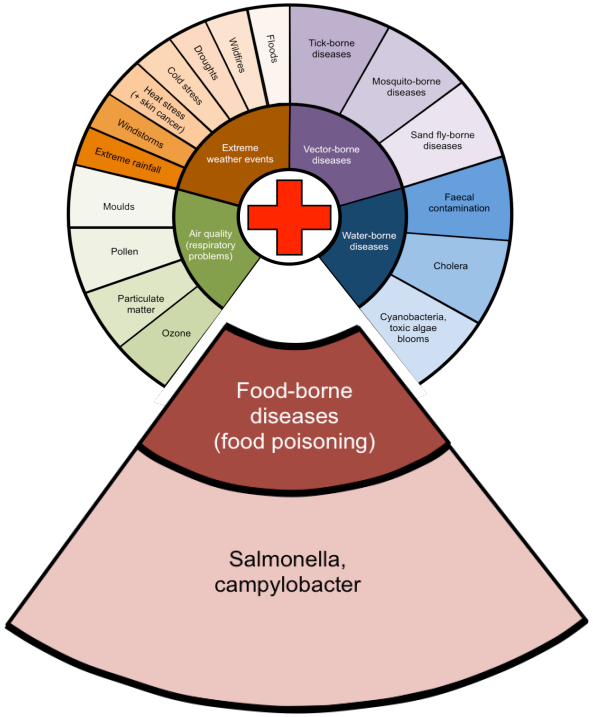
In many parts of the world, water quality of inland streams, rivers and coastal waters suffers from pollutants from population and (agricultural) land use. This pollution may change because future precipitation will change, and so will pollutant transport to water bodies, and dilution of pollutants during high and low flows. Future variations in land use/management may be as important as the effects of climate change on in stream microbial pollutant loads. More intense precipitation will contribute a greater fraction to direct runoff and may also cause a nonlinear increase in sediment erosion and pollutant loading such as manure applied to land as fertilizer.

In temperate seas such as the North Sea and the Baltic Sea, and in lakes harmful (toxic) algal blooms will probably increase as a result of climate change. Toxin-producing species may seriously disrupt the food web and lead to fish kills and human intoxication. Future toxic phytoplankton blooms may further devaluate ecosystem deliverables such as fish production or recreational use.

Health

Food-borne diseases

Adaptation strategies



Adaptation strategies:

- Watershed protection laws
- Water quality regulations
- Regulations to control food-borne diseases and contaminants
- Surveillance and monitoring programs
- Educational programs on food handling

The impact of climate change on foodborne parasites is complicated and provides no easy answers. Many parasites are likely to persist and adapt to the changing climate.

Studies indicate that by the 2050s there will be a 5-20% increase in food-borne illness as increased temperatures facilitate bacterial growth.

Health

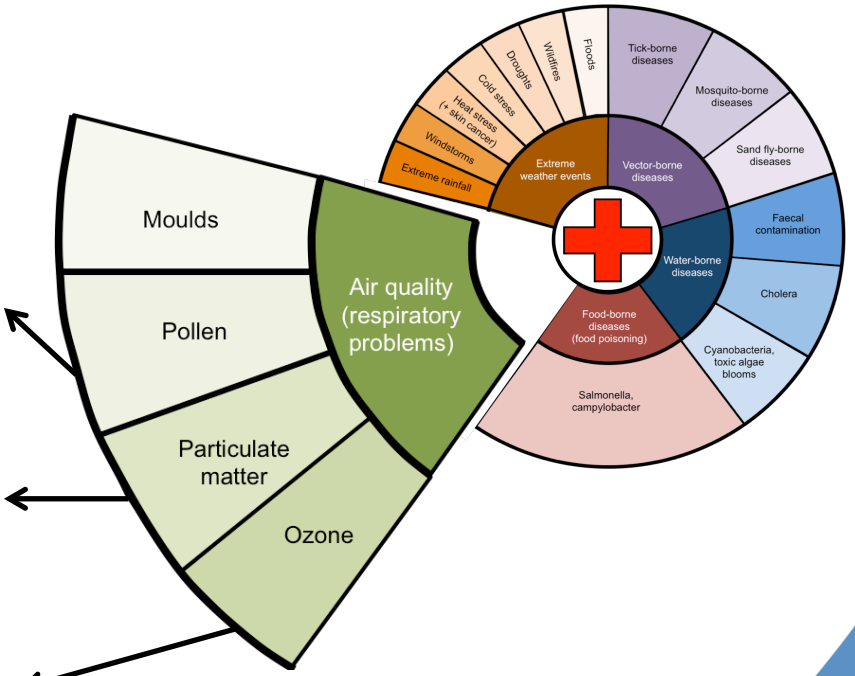
Air quality

Present

Overview

Fine particulate matter and ground level ozone (O_3) are generally recognised as the two pollutants that most significantly affect human health in Europe. Of particular concern are particles with a diameter of 2.5 µm or less (PM2.5) since these could pass from the lungs into the bloodstream.

In Europe, 400,000 to over 600,000 premature deaths each year are attributed to poor air quality. The total external costs of the health impacts are estimated at €330-940 billion.



Pollen-related allergic diseases may well account for 10-20% of allergic diseases in Europe.

Exposure to PM2.5 is associated with an increased relative risk of lung cancer, cardiopulmonary and all-cause mortalities. High levels of man-made particulate matter shorten each EU citizen's life expectancy by over 8 months on average.

Ozone causes 20,000 premature deaths per year in the EU. Ozone exposure is associated with increased incidence of cardiovascular, respiratory and all-cause mortality.

During the European summer heat wave of 2003, possibly 50% of the deaths could have been associated with ozone exposure rather than the heat itself.

Health

Air quality

2100

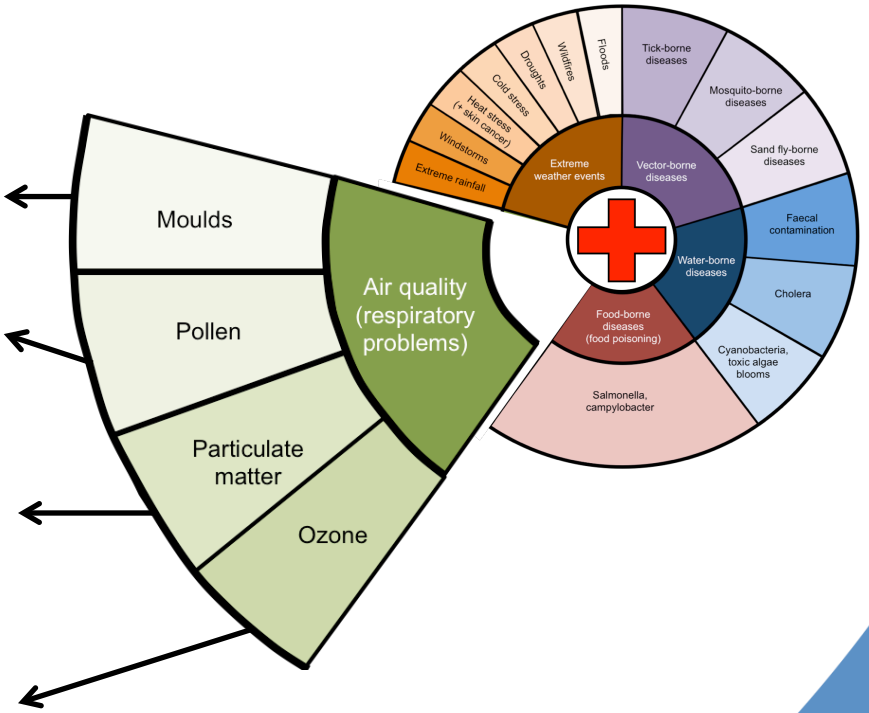
Overview

Mould growth is likely to become more widespread. Moulds are well recognized triggers for allergy sufferers and asthmatics.

Allergenic diseases caused by pollen may appear earlier in the year and may also increase.

At the end of this century, under a moderate scenario of climate change, global mortality associated with PM2.5 may increase by 4%. If forest fires become more common, airborne particulates may have an adverse health impact.

Research indicates that at the end of this century, under a moderate scenario of climate change, global mortality associated with ozone may increase by 1%.



However:
Projections of air quality changes over Europe under climate change are highly uncertain.

Health

Air quality

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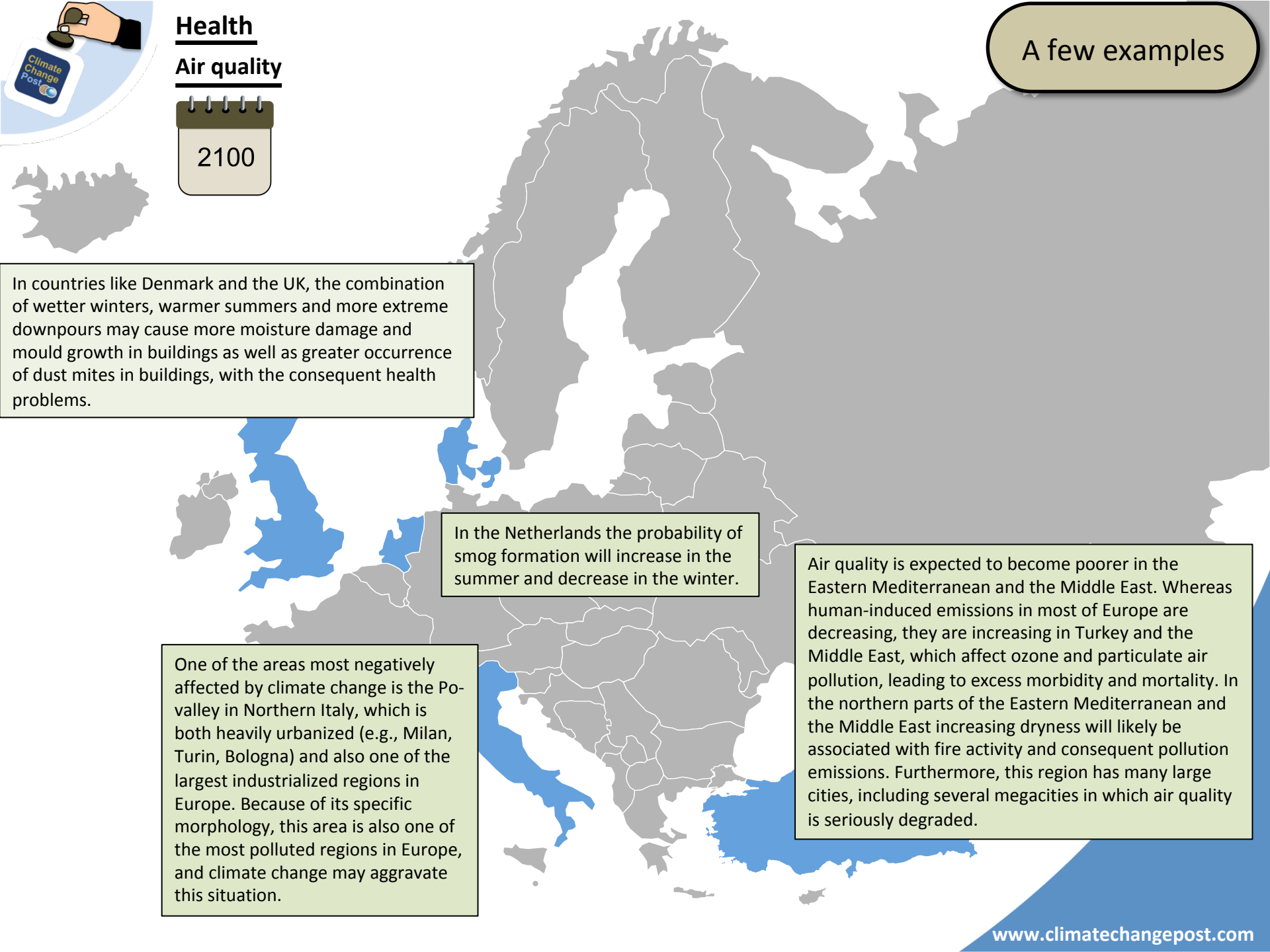
A few examples



In countries like Denmark and the UK, the combination of wetter winters, warmer summers and more extreme downpours may cause more moisture damage and mould growth in buildings as well as greater occurrence of dust mites in buildings, with the consequent health problems.

In the Netherlands the probability of smog formation will increase in the summer and decrease in the winter.

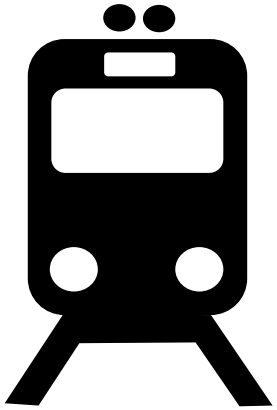
Air quality is expected to become poorer in the Eastern Mediterranean and the Middle East. Whereas human-induced emissions in most of Europe are decreasing, they are increasing in Turkey and the Middle East, which affect ozone and particulate air pollution, leading to excess morbidity and mortality. In the northern parts of the Eastern Mediterranean and the Middle East increasing dryness will likely be associated with fire activity and consequent pollution emissions. Furthermore, this region has many large cities, including several megacities in which air quality is seriously degraded.

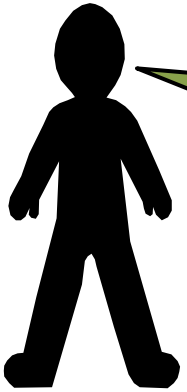
One of the areas most negatively affected by climate change is the Po-valley in Northern Italy, which is both heavily urbanized (e.g., Milan, Turin, Bologna) and also one of the largest industrialized regions in Europe. Because of its specific morphology, this area is also one of the most polluted regions in Europe, and climate change may aggravate this situation.

Health

Air quality

Adaptation strategies





Human adaptation to increased air pollution may not be possible since physiologic mechanisms to decrease susceptibility to air pollution are limited. Adaptation as a risk management strategy can, however, also focus on the reduction of the effects of changing climate conditions on urban heat islands and air pollution.

Adaptation may include interventions to reduce air pollution impacts, especially emissions reduction measures including: traffic restrictions; restrictions on processes and materials releasing volatile organic compounds; improved public transport; pollution warning system.


Climate
Change
Post