

Impact of climate change on populations

Coastal communities

Coastal communities are already being hit hard by climate change

Among the most vulnerable populations are those living next to the sea or relying on the sea for their livelihoods. Higher sea levels and storm surges are already reshaping low-lying coastal areas.

In West Africa, maps of the coastlines of Senegal, Ivory Coast, Togo and Benin show that shorelines are receding at a rapid rate. Between 1984 and 2016, worst-affected Senegal lost a total of 510,000 square metres of land every year. Meanwhile, Benin may have a smaller shoreline, but it is receding at more than twice the rate – around 4 metres per year. Erosion leads to loss of homes, agricultural land and roads.

As well as physical damage, the sea can contaminate freshwater supplies with salt water, making land unfit for agriculture or human inhabitancy. Coastal communities can also expect more flooding, thanks to extreme weather and rising seas. As well as the initial damage, disruption of water supplies increases the risk of transmissible diseases. Mould is a problem as buildings dry out – causing respiratory problems such as the ‘Katrina cough’ seen in New Orleans after Hurricane Katrina.

Aquaculture – the farming of fish and shellfish – is an expanding sector, employing some 19 million people, 96% of whom are in Asia. The industry is highly vulnerable to climate change – from sea and storm damage to the biological impact on fish. Warming seas and acidification are expected to affect farmed species.

Animals

How are populations responding to climate change?

There is now plentiful evidence that climate change is affecting ecosystems, often together with other human-driven environmental change. Some species adapt, because they are flexible enough to survive different environments. Others can migrate to more suitable locations (cold-adapted fish are swimming north, for example).

But many species cannot do either. And an ecosystem as a whole cannot simply up sticks to a more suitable location. The speed of change is thus threatening to disrupt countless existing ecosystems. In 2019, a study by more than 60 scientists published in the journal *Nature* suggested that even if species are adapting, many are unable to do it fast enough to keep up with the pace of change in their environment.

However, some species, particularly ‘generalists’ that are not too fussy about their surroundings, may thrive. Invasive species, moving away from natural enemies such as herbivores, predators, pathogens or parasites, may also do well.

Which species are affected?

Certain species that are known to be dependent on a specific climate are expected to be affected.

For example, a reduction in the extent and thickness of sea ice in the Arctic threatens polar bears. In the southern range of the polar bear’s habitat, climate change is causing sea ice to melt earlier in the spring and form later in the autumn, shortening the period when bears can hunt seals and fish and restore their body fat and fitness. This is a particular problem for pregnant or nursing bears and their cubs.

Globally, insects are declining due to loss of habitat as land is converted into farmland. One 2019 paper suggests that more than 40% of all insect species face the threat of extinction. This figure includes nearly half all bee and ant species. Climate change heightens the risk of species loss through temperature increases above species’ optimums. Whilst, some scientists have suggested that tropical insects may be more sensitive to temperature changes than their temperate relatives, recent research suggests both face a similar risk.

Climate change may even impact on sex ratios in certain animals; for many species of reptile, for example, the sex of their offspring is dependent on temperature. This is called temperature-dependent sex

determination (TSD). In 2006, researchers reported that warmer temperatures in the northeast Atlantic Ocean were causing a sharp spike in the numbers of baby snake pipefish due to changes in sex ratios. Based on laboratory studies, there will also be changes in the sex ratios of sea turtles and some fish.

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Rural communities

Poor farmers will bear the brunt of climate change

Globally, there are around 500 million smallholder farms, 80% of which are in sub-Saharan Africa. Most smallholder farmers grow just enough to feed themselves and their families. Food shortages are common. In 2017, the Food and Agriculture Organisation estimated that there were 815 million people suffering from chronic undernourishment.

Widespread and severe hunger and undernourishment are most common in low-income countries in sub-Saharan Africa and South Asia where employment in agriculture is high. Areas that are already hard-pressed are facing further hardship due to drought or more unpredictable weather caused by climate change and pressure on communities is only likely to increase.

According to the latest Intergovernmental Panel on Climate Change (IPCC) report, published in 2014, for every degree that the mean global temperature rises, an additional 4 per cent of the Earth's land area is projected to suffer a 30 per cent or more decrease in its groundwater resources. An additional, more severely affected 1% of the Earth's land area will suffer decreases of over 70%.

In Central and South America, whilst higher rainfall could increase productivity in certain regions, the opposite effect is predicted in poor areas of Central America and parts of the Andes, which will suffer rising temperatures and lower rainfall, leading to increasing food insecurity within the next decade. It's estimated that South America could lose up to a fifth of its arable land by the end of the century due to the joint pressures of climate change and a growing population.

Whilst increasing temperatures may temporarily benefit crop yields in some parts of the world, in countries where yields are reduced, communities that depend on subsistence farming for survival will be hard-pressed to cope with lower crop returns. Mass starvation and displacement are real possibilities.

In 2019, the IPCC warned that a rise in temperature of 2°C, which is already expected, could trigger an international food crisis in the near future. Ongoing food insecurities for 33 million people in the Sahel region of Africa (including Mali, Niger, Chad and Burkina Faso) in recent years are an example of how climate change is making life harder for some of the world's poorest rural communities. Here, the temperature is rising 1.5 times faster than the rest of the world and the rainy season is growing shorter. Sahel suffered a food crisis in 2012 and many farmers are now crossing borders in search of more fertile ground, but are instead meeting with conflict and violence in this increasingly unstable region.

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The West

With its extensive infrastructure and resources, the West is better placed to withstand climate change – but it will not escape unscathed

Rich countries can take steps to prepare for climate change, and their health systems are better equipped to respond to new challenges, such as:

- more heat-waves and heat-related illness
- more respiratory conditions (due to allergens such as pollen, as higher carbon dioxide levels accelerate plant growth)
- the impact of extreme weather – flooding or severe storms
- new or more cases of infectious diseases: Lyme disease may become more common; more *Salmonella* and other intestinal infections are likely and some southern and eastern European countries will face an increased risk from malaria due to the extension of the transmission season
- skin cancers may increase (if people spend more time outside).

The impacts of climate change may not always be obvious. For example, the incidence of kidney disease, including kidney stones and recurrent urinary tract infections, may increase. US research has identified a link between temperature and a 'kidney stone belt' in southern states, which will move northwards as climate change progresses. Epidemics of chronic kidney disease that are already occurring in Florida and California are being linked to dehydration and heat stroke caused by heat waves, which will become more common under climate change.

Economically, countries need to devote resources to preparing for climate change and take steps to minimise its impact. In the UK, £17 billion is spent by the government annually on preparations for climate change, though environmental groups argue that this figure needs to double.

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Urban communities

More people now live in cities than in rural areas

Over half of the world's population lives in cities. Migration from rural to urban environments is increasing, with 68% of people expected to live in cities by 2050. However, in a warming world, cities may not be the healthiest place to live and dense populations mean many people's health is at risk.

Not only do cities bring together more people and more pollution, under climate change they will also get hotter than surrounding rural areas, due to a phenomenon known as the 'urban heat island' effect. In cities, vegetation has been replaced by buildings, roads and other heat-absorbing infrastructure. This difference in temperature could increase heat-related illnesses, whilst hard surfaces make coastal cities more vulnerable to floods. Meanwhile, as populations continue to grow, overcrowding will put further pressure on health systems and promote the spread of infectious diseases.

One of the major concerns related to health in cities is higher urban temperatures increasing the impact of air pollutants, including particulate matter and NO_x (nitrogen oxides), from traffic and industry. Increased sunlight could also lead to more ground-level ozone, which is associated with a wide range of respiratory conditions. In China, where air pollution kills more than a million people a year, climate change is expected to intensify the impact of air pollution, leading to yet more deaths. Densely populated urban areas will be worst affected.

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Coral reefs

These beautiful structures protect coastal regions and provide food and livelihoods for hundreds of millions of people

Corals are the most biodiverse parts of the ocean and provide a livelihood for people through tourism and fishing. The Great Barrier Reef alone is home to 1,625 species of fish, more than 600 types of coral and six out of seven of the world's species of marine turtle. It also supports 64,000 jobs.

However, corals are especially susceptible to climate change owing to their sensitivity to temperature and acidification. Due to an ocean heat wave, between 2014-2017, corals around the world suffered mass 'bleaching', in which the symbiotic relationship between the coral and the algae living in its tissues is disrupted. Bleaching leads to death of the coral. These mass bleaching events used to occur only every 25-30 years, but they are now happening much more regularly – as often as every six years – meaning the reefs do not have time to recover.

According to the 2014 Intergovernmental Panel on Climate Change (IPCC) report, coral reefs are one of the most vulnerable marine ecosystems and more than half of the world's reefs are at a medium or high risk of degradation. In 2019, an Australian government report downgraded the future outlook for the Great Barrier Reef from 'poor' to 'very poor', stating that climate change posed its greatest long-term threat.

Will coral reefs survive? There is hope that some species of coral will be able to adapt to higher temperatures as found in a 2018 study that tested two species of corals from Florida and the Caribbean in warmer waters. While staghorn coral died at temperatures just 1.5°C above the Florida average, mountainous star coral survived for two months at the higher temperature and recovered after. The researchers predict that some species of coral may therefore be able to cope, though perhaps only in the short-term.

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Mental health impacts of climate change

Climate change affects people's mental as well as physical health

As well as causing physical harm through injuries, malnutrition and infections, climate change can also harm people's mental health. Mental trauma following the loss of one's home, livelihood or loved ones will inevitably lead to more anxiety, depression and post-traumatic stress disorder (PTSD). Research in the US and Mexico also shows that higher temperatures are associated with an increase in suicide rates.

In 2019, the University of Copenhagen published a national survey of the human impact of climate change in Greenland. According to the results, Greenlandic people are already exhibiting signs of 'ecological grief', anxiety and PTSD related to climate change. Their associations with climate change are broadly negative, with specific concerns surrounding, for instance, dangerous travelling conditions as sea ice melts and harm to their animals and plants. Mental health professional from the region say the psychological impacts of climate change are not being given enough consideration.

Those already suffering from chronic health conditions and other vulnerable groups will be more susceptible to mental health impacts. People in low- and middle-income countries already have limited access to mental health treatments and it is unclear what sort of therapy would be appropriate for the large numbers who will be affected by climate change.

The burden of mental health

It is estimated that around 8% of disease globally is accounted for by mental health conditions. Yet in many countries mental health remains low on the lists of priorities. As a result, the World Health Organisation (WHO) says we are facing a global human rights emergency in mental health.

The Boxing Day tsunami of 2004, which killed 280,000 people and led to 1 million losing their homes, hinted at the mental impact that environmental disasters can have. Research suggests that half of all survivors suffered some kind of mental health issue, with 40% of children showing signs of PTSD.

In addition, there was a rise in PTSD and depression in communities affected by Hurricane Katrina that got worse over the course of the following year. People did eventually recover and rates dropped back down. However, given that climate change is not a one-off event, it may be more difficult to gauge its true impact. Some psychological impacts of such a crisis may be complex and widespread without necessarily showing up in mental health statistics.

More positively, the response to the Boxing Day tsunami in a number of countries included a mental health element, and benefits have been documented in several communities. Planning for mental trauma can form a part of preparing for climate change. Indeed, the tsunami has been a spur to many affected countries to put in place plans for emergency mental healthcare responses. Meanwhile, the study of mental health and climate change is an expanding area with researchers beginning to stress the need for adaptation measures to address the psychological impacts of climate change.

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