- Greenhouse effect / Climate change





DID YOU KNOW? Between 1880 and 1980, the average global temperature rose by just 0.07 degrees Celsius

Visit Planet Earth 2125

WORDS SCOTT DUTFIELD

How might our world have transformed under the strain of climate change 100 years from now?

A century ago, our planet was a much cooler place – around one degree Celsius cooler, to be exact. However, since the start of the Industrial Revolution in the late-18th century, Earth has been getting much hotter. The invention of fossil fuel-guzzling machines, such as internal combustion engines and steam trains, has propelled the planet into a new technological era, but has also set it on a trajectory of self-destruction. As a byproduct of early industrialisation, the atmosphere has been saturated by a global outpouring of toxic pollutants called greenhouse gases.

One of the most damaging greenhouse gases is carbon dioxide, which acts like an atmospheric blanket, wrapping Earth in its cosy embrace. In 2023, the global output for carbon dioxide was 37.4 gigatonnes,

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Dangerously hot

Why warming the world comes at a hefty environmental cost



1 PRECIPITATION
As the global temperature increases, so does the amount of evaporation in the water cycle, intensifying precipitation.

2 MOUNTAIN ICE AND GLACIERS
Melting snow and ice from mountains and glaciers release water that flows into water basins on land, leading to flooding.

4 SEASONAL RHYTHM
Global temperature also dictates when flowering plants emerge from winter, which is becoming earlier each year as the world warms.

6 OCEAN ACIDIFICATION
As more carbon dioxide collects in the atmosphere, it dissolves into the oceans. This lowers the pH of the water, making it more acidic.

7 SEA LEVEL RISE
Melting sheet ice and the thermal expansion of seawater contribute to sea levels rising.

8 GAS RELEASE
Greenhouse gases such as methane that are trapped in permafrost are released when it melts.

9 EXTREME WEATHER
Heavier rainfall and changes in heat-driven air pressure increase the frequency of extreme weather events like heat waves and typhoons.

10 CURRENT FLOW
As more ice melts into the ocean, its salinity is reduced, and so is its density. Changes in ocean density alter currents around the world.

"Earth could face a global temperature increase of 2.7 degrees Celsius by 2100"

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DID YOU KNOW? Coral reefs could decline by up to 90 per cent by 2100 with a warming of 1.5 degrees Celsius



growing 1.1 per cent from the previous year. However, when the insulating carbon dioxide blanket gets too thick, many of Earth's natural processes fall out of balance, leading to extreme weather events like raging wildfires and rising sea levels – just two of the many ways climate change alters the world.

And global warming can be a vicious cycle: as a result of global temperatures rising, the world's ice and snow are melting. Since the 1900s, the rate of decline of global ice has risen by 57 per cent. This has a direct effect on our planet's ability to deflect the heat of the Sun's rays, known as the albedo effect. Light-coloured surfaces on our planet, such as snow and ice, reflect solar radiation, while dark colours absorb it, along with its heat. The less ice and snow available to reflect solar radiation, the more heat that's absorbed, which leads to further warming.

The world is going to warm up in the next 100 years, climbing to temperatures two degrees Celsius higher than they were before the Industrial Revolution. The United Nations (UN) Panel on Climate Change has warned that crossing a rise of just 1.5 degrees Celsius will have severe climatic consequences, while limiting this rise can decrease the risk of long-lasting or irreversible changes to our climate. For this reason, 196 countries have adopted an international treaty on climate change, called the Paris Agreement, to reduce their emissions and help curb the rising temperatures.

Did you know?
The last decade has been the hottest in 125,000 years

Currently, Earth could face a global temperature increase of 2.7 degrees Celsius by 2100. The most bleak of estimations have suggested that the world could experience a global temperature rise of over four degrees Celsius. And gas emissions and climate change aren't the only Earth-altering problems we face. It's estimated that Earth will be home to over 10 billion people a hundred years from now – a population that our planet might not be able to sustain. As medical advances increase life expectancy and birth rates outweigh deaths, the human population will continue to grow. With that comes a demand for resources, such as food, water and space to occupy.

The point at which the environment is unable to provide enough resources to support a species is called its 'carrying capacity'. Scientists are unsure what exactly Earth's carrying capacity for humans is. Some estimates say that our current population of 8 billion is enough to tip the scales, while many other studies suggest that 16 billion people would be the limit to sustain human life. Some estimates have predicted that by 2070 as many as 3 billion people may have to move from their homes around the world in response to climate change.

The current climate

0.06 DEGREES CELSIUS
The average increase in land and sea temperature per decade since 1850

2024
Last year was the hottest year since records began in 1850

50 PER CENT OF VEGETATIVE LAND IS USED FOR AGRICULTURE

101.4 MILLIMETRES
Sea levels have risen a mean of over ten centimetres compared to 1993's levels

FOR 20 DAYS A YEAR, AROUND 30 PER CENT OF THE GLOBAL POPULATION IS EXPOSED TO DEADLY HEAT WAVES

1.52 BILLION HECTARES
15.5 per cent of land is degraded by global warming

300 TO 900%
High-tide flooding has dramatically increased since 50 years ago

SINCE 2000, DROUGHTS HAVE INCREASED IN FREQUENCY BY OVER 29 PER CENT

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Earth now and then

How our planet might change in the next 100 years if we exceed 1.5 degrees Celsius of warming

1 DIFFERENT LANDSCAPES
According to a study published in the journal *Nature Communications*, 23 per cent of natural habitats will be lost over the next 80 years. The world may see increasing degradation, along with changes to different ecosystems such as forests and grasslands. However, some regions of the world may fare better than others. By 2100, the United States' northern red oaks forests may have moved northwards to adapt to hotter temperatures.

3 FOOD PRODUCTION
Many crops may be harder to grow in the future. Equatorial regions might become too dry and hot for farmworkers to cultivate by 2100. To meet the food demands of a potential global population of over 10 billion, its estimated that we'd need additional agricultural land nearly twice the size of India, or around 593 million hectares, to produce enough food. Advances in technology such as engineered crops might be able to tolerate future climates.

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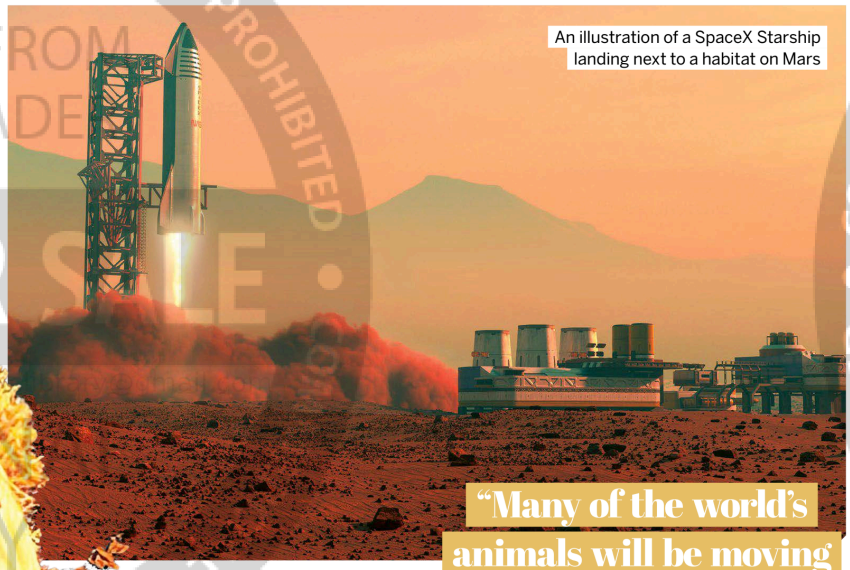
DID YOU KNOW? The United States could experience sea level rises of 3.9 metres by 2150 in a worst-case scenario



5 RENEWABLE ENERGY
Around 100 years from now the world will likely be fuelled entirely by renewable means. Sweden and Germany plan to be powered by renewable energy by 2040. In 2022, researchers analysed the efficiency of renewable resources, such as solar panels and wind turbines, and concluded that it would be theoretically feasible for the world to be powered 100 per cent by renewable systems as early as 2050.

4 EXTREME WEATHER
The occurrence of extreme weather events is already on the rise and sure to increase by 2125. According to the United Nations Environment Programme (UNEP), the most extreme wildfires may rise by up to 50 per cent by 2100. Researchers have also estimated that the occurrence of consecutive damaging hurricanes may increase to every two to three years in some parts of the world by 2100.

2 SEA LEVELS
Since 1880, the mean global sea level rise has been 21 to 24 centimetres. If the world temperatures exceed a rise of 1.5 degrees Celsius, the National Oceanic and Atmospheric Administration (NOAA) predicts that global mean sea levels will rise 0.3 metres to two metres above 2000 levels by 2100. Islands and coastlines will be most affected: it's estimated that 60 per cent of West Africa's coastline will be lost by 2100.



An illustration of a SpaceX Starship landing next to a habitat on Mars

"Many of the world's animals will be moving closer to the poles"

It's not just humans that will be on the move to avoid changing climates. Many of the world's animals will also be moving closer to the poles. Studies have shown that 70 per cent of terrestrial species have migrated to more northerly or southerly latitudes in the last few decades. Scientists have estimated that plants and animals need to shift their ranges by around two miles per year to keep up with increasing global temperatures. But a world filled with northward-moving animals means trouble. Invasive species compete with native species for resources and lead to extinctions. Species that can't migrate or extend their range will likely go extinct. Studies have estimated that as many as 80,000 species within 35 of the most biodiverse areas will be lost by 2100.

This shift in animal ranges can also have direct implications for human health. Killing up to a million people each year, mosquitoes are the deadliest animal species in the world. Many species of these tiny insects carry a malaria-causing parasite that can be transmitted through their mouths after a bite. Currently, these mosquito species are mostly found in sub-Saharan Africa, Central and South America and Southeast Asia. As the world warms, the range of these tropical-dwelling insects will also expand, increasing the 'epidemic belt' of the disease. In 2021, a study was published in the *Lancet Planet Health* that estimated that an additional 4.7 billion people could be at risk of contracting malaria or dengue fever – another mosquito-transmitted viral disease – by 2070 as a result of migrating mosquitoes.

Did you know?
Earth is currently home to 8.2 billion people

So what can we do to avoid the worst effects of a warming world? Shifting energy production away from fossil fuels to renewable emission-free systems, such as solar power, is one of the best ways to help stop the planet from getting any hotter. Next is to try and strip excess carbon dioxide from the atmosphere. Increasing carbon-capturing forests and other natural carbon stores can help lower global temperatures.

But could humans venture beyond Earth and settle in space by the year 2125 in a worst-case global-warming scenario? Tech billionaires such as Elon Musk and Jeff Bezos have been toying with the idea of creating homes away from our home planet for years. From orbiting hotels to Martian neighbourhoods, 2125 could well see humans venturing beyond Earth and settling elsewhere in the Solar System. But this won't help solve the problems on our planet and comes with its own set of challenges. Rockets, such as the SpaceX Starship, have a human payload of just 100 people. Getting enough people off the planet to help reduce the effects of climate change would mean hundreds of thousands of space-bound volunteers each day. Reducing our negative impacts on the climate might be the best way to ensure humans can still thrive come 2125.

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Did you know?

China is the largest emitter of carbon dioxide on Earth

New natives

Some of these animals might find new homes to escape the worst effects of climate change

"2125 could well see humans venturing beyond Earth and settling elsewhere in the Solar System"



1 SMALL FISH

Marine food sources such as sardines will likely move to cooler waters in the next 100 years. Research shows that these small fish might move from the North Sea to the coast of North Russia.



2 SEABIRDS

Some seabirds may follow marine food north, such as the great black-backed gull. Seabirds may find new habitats in mainland Europe or the Norwegian archipelago of Svalbard.



3 SHARKS

Along with around 12,000 marine species, by 2100 whale sharks are predicted to follow a change in habitat from areas such as the gulf of Mexico across the Atlantic Ocean to deeper, cooler waters.



4 TERRESTRIAL BIRDS

Some African avian species, such as the long-legged buzzard, may make a move to Southern Europe.



5 LARGE HERBIVORES

As climates warm and plant species move north, herbivores will follow suit. For example, it's thought that Asian elephants may move from Burma to find new habitats in Nepal.

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DID YOU KNOW? By 2100, summer temperatures across the United States could rise by around four degrees Celsius





Taking a break from Earth

If life on Earth gets too hot, there might be the option of leaving for greener pastures... in space

1 ORBITAL CITIES
Could humans be living in cities orbiting Earth by 2125? First proposed in 1974, an orbital space settlement is a pressurised structure that's theoretically large enough to house cities and homes. Currently, companies such as the Orbital Assembly Corporation and Virgin are planning on constructing similar, but much smaller space hotels within the next decade.

2 LUNAR GETAWAY
Humans will set foot on the Moon again as soon as 2026, but by 2125 there could be whole colonies of people calling it home. Countries such as China are working to build lunar bases by 2035. While the rocky satellite is devoid of air and Earth-like daylight, artificial life-sustaining technology could shelter future lunar residents, providing food and breathable air.



6 CARNIVORES
Over the past few decades, the red fox has been steadily increasing its range in Canada to hunt for food and has begun to move into the North American tundra.



3 MAKING MARS HOME
The concept of colonising Mars has been around for decades. There are already projects in the works that could see astronauts walking on the Red planet within the next few decades, such as the Mars Base Camp by Lockheed Martin. And if humans can combat the radiation, freezing temperatures and toxic dust to produce their own food, then Mars might be ready for its first inhabitants.

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