

(not fully edited)

2015 in Paris;

Now we have agreed on what we should do to make the world a better place. *(Thump, thump, photos, group photos, thump, thump in the back)*



But of course we do what we want when we get home!

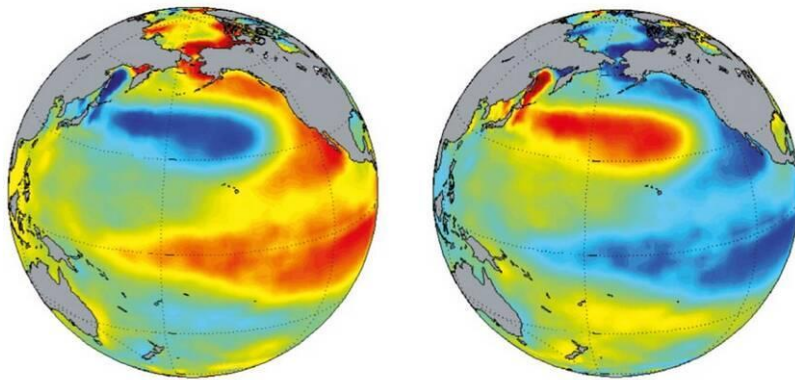
In 2019, climate scientists asked the question: **Where did the warming go?**

2024 is the question: **What is the rapid acceleration of warming due to?**

(UNDERLAG SVT News 18 DECEMBER 2019)

Since 1998, the global temperature has increased much more slowly than previously predicted, measurements show. It rhymes badly with several climate scientists' models and now they are trying to explain the 16-year-long "pause" in the warming.

Between 2019 and 2024, warming has increased in a dramatic way that also does not follow the forecasts that have been created.



The graphic shows two globes, the left one during the "warm phase" and the right one during the "cold phase". **Photo: NOAA**

So let's start with the question; What happens when temperatures rise? (Nature Conservation Society)

<https://www.naturskyddsforeningen.se/artiklar/den-globala-uppvarmningens-konsekvenser/>

What does 1 degree higher average temperature mean? (Source

Nature Conservation Society)

In the world we live in right now, the global average temperature has increased by just over one degree compared to pre-industrial times. In the Arctic, to which northern Sweden belongs, the warming is two to three times as fast and the average temperature there has already increased by more than two degrees. The increased temperature has already had clear effects around the world. Some of them are:

- The Arctic has sea ice extent, measured in September each year, decreased by about 13 percent per decade since 1979. Then the ice melts absorb the dark water formed more of the solar radiation, which further accelerates the melting.
- Heat waves has become more common in the Mediterranean and the Middle East.
- Dry and acute water shortages are an increasingly widespread problem, among other things, on Horn of Africa and in South Africa.
- floods, Mudslides and rainstorms have become more common in the Andes, among other places and the Himalayas.
- The average sea level has already risen by about 20 centimeters, making it easier for storm surges and hurricanes to reach further in over land with large bodies of

water.

- Coral bleaching destroys coral reefs around the world on a large scale. Mortality has been more than 50 percent for previously healthy coral reefs in general. The barrier reef off the coast of Australia.
- Four fifths of all ecological systems on earth are already affected in some extent of climate change.

What does 1.5 or 2 degrees higher average temperature? (Source Nature Conservation Society)

Some of the effects that the collected research establishes will occur- at a warming of 1.5 to 2 degrees is:

Heat waves: About 14 percent of the world's population will be exposed to extreme heat waves at least once every five years if the average temperature increases by 1.5 degrees. If the temperature increase exceeds two degrees, more than a third of the world's population (37 percent) will be exposed to the same risk.

Rising sea level: In a world with 1.5-degrees higher average temperature than today, the sea level is estimated to rise by 40 centimeters by the year 2100. At two degrees of warming, the same figure rises to 46 centimeters.

That may sound like a pretty small change, but such an increase would leave about a tenth of Bangladesh under water.

There are also studies that speak of a significantly stronger sea level rise, up to two meters in a hundred years. How much it actually is depends, for example, on so-called threshold effects, in case critical values will be exceeded that allow the earth to become self-warming.

Sea level rise also makes coasts more vulnerable to flooding from high tides, storms and hurricanes. Low-lying parts of coastal cities, such as Calcutta and Bombay in India or Miami and New York in the United States, may periodically be submerged.

Dead coral reefs: Coral reefs are very sensitive to temperature changes and risk disappearing completely. At 1.5 degrees of warming, 90 percent of the world's coral reefs risk disappearing completely. At two degrees of warming, all the world's coral reefs are threatened, as much as 99 percent will disappear. This also threatens all the species that live in and around the coral reefs.

Altered ecosystems: Many of the world's ecosystems will not be able to adapt to a changing climate when warming proceeds as fast as it does. Instead, they risk being transformed into completely new types of areas. An ecosystem that is singled out as particularly sensitive to this is the boreal forest in Northern Europe, i.e. the spruce and pine forest that we have a lot of here in Sweden.

Reduced yields: Drought and water shortages will lead to reduced harvests in large parts of the world. If the temperature rises by two degrees, the maize harvests in tropical areas are estimated to decrease by seven percent. It may not sound like much, but considering that the earth's population will increase at the same time, it will have devastating consequences.

Uninhabitable areas: Already today, between 15 and 20 million people a year are forced to abandon their homes due to weather-related natural disasters. The number of homeless people after extreme weather events is expected to increase sharply in a warmer climate. Many people today live in vulnerable areas, and the number is increasing as more and more people settle in low-lying coastal areas and vulnerable cities in poor countries.

What does warming 2 degrees higher average temperature mean?` (Source Wikipedia)

No climate scientist knows for sure what will happen if the warming continues and the uncertainty is also great as to how big the warming will be. According to the IPPC's Fourth Report, presented in 2007, warming by the year 2100 is likely to be somewhere in the range of 1.4 to 4.5 °C. In a "worst-case scenario", the Earth's average temperature is estimated to increase by roughly 6 °C over the next century. This applies to it *global average*. The seas will warm up less than land and some areas, mainly the polar regions and the cold temperate areas will warm up much more, in some cases more than double or even. three times as much compared to the average for the entire globe.

The scenarios below for the various continents are based on advanced data-simulated climate models, but there are several uncertainty factors. No one knows, for example, how much greenhouse gas emissions will increase/decrease in the future and how natural phenomena such as [The boy](#) will be affected by continued warming. We know for sure how much of the ongoing warming is caused by human activities. It is also not known exactly how strong warming is required to activate so-called positive feedback mechanisms, i.e. processes in nature that in various ways amplify the warming on their own. In other words, it is not a given that the gloomy future scenarios that the IPPC and others predict and that are presented below will occur.

In the most pessimistic forecasts, it is the positive feedback mechanisms (thawing permafrost, melting polar ice and glaciers, release of [methanhydrater](#) etc.) that completely take over and the process is rampant, regardless of what the person does. However, most climate scientists believe that the critical level is around 2.0 °C. According to the IPPC, the warming since 1900 is approximately 0.75 °C

[Africa](#) is the continent that risks being hit the hardest.^[3] In the world's poorest continent, the majority of the population (70 percent^[3]) on agriculture and warming is expected to hit very hard when rainfall decreases in large parts of Africa. The risk is palpable that hundreds of millions of Africans will become climate refugees due to drought and famine in the coming century. Even with a warming of

around 3 degrees, according to many climate models, large parts of southern Africa will become uninhabitable due to drought and desertification.

The Nile Delta and [Egypt's](#) capital [Cairo](#) at risk of flooding when sea levels rise.

North America

In [Alaska](#) and in [Canada tundra areas](#) risk [the permafrost](#) to thaw.

The warming will probably be greatest in the Midwest (primarily in [Kansas](#), [Nebraska](#) and [Iowa](#)^[4]) as well as the south-western parts with, among other things, the states [California](#) and [Arizona](#).

In the western parts of the United States, precipitation is expected to decrease significantly at the same time as the glaciers in [Rocky Mountains](#), [Sierra Nevada](#) and [Kaskadbergen](#) gradually melts away. The drought and the reduced availability of water risk causing very large problems with the water supply and agriculture in the western United States. Huge forest fires will probably become more common. Many also believe that the tropical cyclones are becoming more and more powerful.

Asia

Big parts of [Asia](#) would probably be hit hard when the glaciers in [Himalaya](#) melts away. The glaciers feed the great rivers [Ganges](#), [Brahmaputra](#), [Yangtze](#), [Mekong](#), [Indus](#) and several with meltwater. The water supply for several billion people is thus at risk of deteriorating. In the IPCC's fourth report from 2007, there was a claim that the Himalayan glaciers could melt away by 2035. Later, the IPCC has distanced itself from this claim, which turned out to be pure speculation and not based on any research.^{[5][6]} According to the IPCC's fifth report from 2014, there is a lack of good knowledge about how much water is in the Himalayan glaciers; estimates vary between 2,100 and 5,800 billion tons. According to an average scenario, the mass of the glaciers is estimated to decrease by 45% by the year 2100.^[7]

Probably would too [monsoon](#) patterns change with potentially catastrophic effects.

The warmer climate leads to a rise in the sea level, which would cause very big problems in low-lying countries such as, for example [Bangladesh](#) and the island states in [Pacific](#).

South and East Asia will probably be affected by more and stronger tropical cyclones.^[8] In the already dry [The Middle East](#) likely to reduce precipitation further.

In [Siberia tundra areas](#) there are also huge amounts of greenhouse gases stored in [the permafrost](#), an estimated 70 billion tonnes [methane](#) and upwards of 1,000 billion tonnes [carbon dioxide](#) in frozen

organic matter. By comparison, the burning of fossil fuels today causes emissions of 7 billion tons a year.[9]

[Methane](#), which is a very strong greenhouse gas, and carbon dioxide will gradually be released if the permafrost thaws, which risks greatly amplifying global warming.

If the Earth's average temperature is raised above 2 degrees, the development will probably be irreversible and the process self-reinforcing. A warmer climate leads to greater thawing of the permafrost, which in turn leads to greater emissions, a warmer climate and even faster thawing and temperature rise.[9] There are signs that the thaw has already started

Europe

In [Europe](#) the Mediterranean area risks being hit very hard with higher temperatures and reduced precipitation. This would hit agriculture and the tourism industry hard. [Greece](#), [Italy](#) and [Spain](#) can be affected by heat waves in the summer with temperatures of 50-55 degrees in the shade and the average summer temperature in Spain may increase up to 7 degrees until the year 2100. In large parts of Spain the summers will then be as hot as in [Sahara desert](#) today. The risk of desertification in the Mediterranean area is also great.[10]

[Central Europe](#) gets a climate reminiscent of it [Mediterranean Sea](#) has today with winter rain and summer drought, very intense heat waves are believed to be increasingly common here as well.

Some climate scientists have expressed concern that the warmer climate may affect [The Gulf Stream](#). [11] Melting ice in the Arctic and Greenland makes the Atlantic less salty, which affects the currents. [12] Since the middle of the 20th century, the North Atlantic currents have decreased by 15%, [13] but according to the IPCC's latest report, there are no signs of any collapse of the Gulf Stream. It could be reduced by 20-25 percent, but the increase in temperature would still more than compensate for this in such a scenario. Europe would thus still have a warmer climate than today. [14]

South America

Above all in [Andes](#) a sharp increase in temperature is expected in the coming century. It has already been established that the warming in the Andes in the last 30-40 years is going significantly faster than the average for the whole world. [16] The warming is felt above all by the retreat of the glaciers at an increasingly faster rate, which in the future will lead to very large problems with the water supply for the population of the huge mountain range and the multi-million city [Lima](#) at [Pacific coast](#) largely desert. Some researchers believe that the situation is so serious that the population of [Peru](#)

and [Bolivia](#) are at risk of suffering from an acute water shortage already in 10–20 years.[\[17\]](#) Also [Amazon region](#) will be warmer. If the global average temperature rises by 3 °C or more, the Amazon rainforest is likely to be wiped out.

Arctic and Antarctic

The polar regions have experienced the fastest temperature increase. The temperature increase over the last 50–60 years is in many places up to 3 °C, well above the average for the entire world.[\[18\]](#) In both [Arctic](#) and [Antarctica](#) the increase in temperature is felt above all by the ice i [Arctic](#) and on [Greenland](#) melts alarmingly fast.[\[19\]\[20\]](#) Even the ice sheet around the Antarctic Peninsula has begun to melt faster.

In September 2012, the smallest ice cover in the Arctic was measured so far (2019). The trend from 1979–2019 is for the ice sheet's annual minimum to decrease by 82,400 square kilometers per year.[\[21\]](#) The increasingly rapid melting means that an accelerating and faster warming than previously calculated is increasingly likely. The warming means that several animal species, for example the polar bear and the emperor penguin, are threatened with extinction.[\[source needed\]](#)

As mentioned above, the permafrost in northern Siberia, Alaska and Canada has also begun to thaw, which could have devastating consequences for the global climate if warming cannot be stopped.

Australia

[Australia](#) which is already the world's driest continent, is likely to warm up significantly and become even drier. In recent years, Australia has been hit by the worst drought in at least 100 years, many say the worst on the continent in over 1,000 years. Many scientists believe that there is a connection between the drought and global warming, and the drought is expected to become even worse in the coming century.[\[22\]](#)

When the sea level rises, the low-lying island states come in [Pacific](#) to get into big trouble. In the worst case, it will be necessary to evacuate the population.

The scenarios are based on climate models with a certain degree of uncertainty. Clearly, however, areas that already receive a lot of rain are seeing increased precipitation, while already low-rainfall regions are becoming even drier, in both cases with potentially catastrophic results.

The tendency for the temperature to rise faster in northern and southern latitudes than in the tropics is expected to continue and be further strengthened, and land areas are warming more than the oceans, which leads to the climate zones moving north and south respectively in the northern and southern hemispheres and the temperature contrasts between the tropics and the colder regions of the earth are reduced. It can already be seen that the heating is going much faster in [Arctic](#) than the average for the entire world. The reduced difference in temperature between the tropics and polar regions can seriously disrupt the large-scale circulation in the atmosphere, which is the primary driver of low pressure formation over most of the world.[\[23\]](#)

An element of uncertainty is the hydrological and climatological phenomenon [The boy](#) which at regular intervals change the current conditions in central [Pacific](#), which in turn upsets weather patterns in almost the entire world. There are concerns that severe global warming could affect the El Niño cycle and, in the worst case scenario, create "mega-niños" that last for decades or make El Niño permanent. The consequences of such a change would be gigantic with difficult-to-overview consequences for the climate on Earth, but the risk is assessed as quite low.

Changed conditions for agriculture

As the climate is expected to get warmer, precipitation patterns change and climate zones shift, the conditions for agriculture and thus the ability to supply the entire world's population with food will be negatively affected. The greater the change in climate, the greater the changes for agriculture. In a study presented in the journal *Science* [Science](#) 9 January 2009 it is believed that the probability is high (>90%) that climate change will have a dramatic impact on agriculture. Strong temperature increases in the coming century will have very negative consequences for both production and income for farmers in the tropical and subtropical climate zone. Even in the temperate areas, the consequences for agriculture will be great. According to the researchers behind the study, the hottest summers recorded so far in the temperate regions will be normal summers by 2100. They also called for swift action to meet this threat [\[24\]](#)

In case of minor climate changes, agriculture in many places in the world, mainly in the higher latitudes, can be improved. This applies to countries that [You have](#), [North-](#) and [Central Europe](#), [Russia](#), [New Zealand](#) and [Chile](#).[\[25\]](#) In other places, certain adaptations of agriculture may be required such as the timing of sowing and harvesting, a different tillage or irrigation.

In the event of major climate changes, one may be forced to change crop types or make more extensive changes in cultivation techniques. Although climate change will mainly affect the mid-latitudes, latitude 40–70°, [\[26\]](#) and the higher latitudes, these countries often have better opportunities for adaptation. The most serious consequences for agriculture may occur in developing countries in the tropics.[\[27\]](#)

Increased risk of war

More and more climate scientists and security analysts also fear that climate change will lead to widespread unrest and even outright war in the hardest hit regions. Even war between states due to climate change is also considered quite possible, even probable. Many countries are identified as future high-risk areas [Africa](#), whole [The Middle East](#), [If-Pakistan](#) and [Depth](#).

Many of the countries are already unstable and when, according to climate models, rainfall decreases in already dry countries in Africa and the Middle East, the countries are likely to experience major internal stresses. Of particular concern to many security experts is the already sensitive relationship between India and Pakistan. Both the states that have nuclear weapons will be hit hard if/when the glaciers in the Himalayas melt and the water supply deteriorates.

In the case of China, the stability of the country is considered to be entirely dependent on the continued strong economic growth. China is considered to be among the countries that will be hardest hit outside of Africa. For example, the water supply for hundreds of millions of Chinese will deteriorate when the glaciers in [Himalaya](#) melts away and which supplies giant rivers which [Yangtze](#), [Huang-Ho](#) and [Mekong](#) with melt water. That growth will continue in the future is far from certain when China is also believed to be affected by a greatly increased frequency of weather-related natural disasters, such as drought and desertification in the northern part of the country and more severe floods and tropical storms in the south

Consequences for nature

The effects in the long term are difficult to predict, but climate scientists, biologists and others agree that effects have already begun to be seen. These are expressed in, among other things, that the growing seasons have been extended, that new plant and animal species establish themselves in areas that were previously too cold for them, and that glaciers throughout the world are retreating.

The oceans

Since the end of the last ice age, the sea level has risen approximately 130 meters. Until the beginning of the 19th century, sea level was probably almost constant for thousands of years. After that, it started to increase and the rate seems to have accelerated in the late 20th and early 2000s. The increase is considered to be caused by global warming and is partly due to the melting of the glaciers and partly to warmer water expanding, i.e. taking up more space.

The increase is likely to continue into the next century and probably well beyond. However, there is great uncertainty about how much the level will be raised. In the UN climate panel [IPCCs](#) fourth report

in 2007, the level was estimated to rise by 18–59 centimeters until the year 2099. A rise of close to 90 centimeters would be more than enough to cause very big problems for low-lying countries such as [Bangladesh](#) and [The Maldives](#). Even many of the world's big cities would be forced to improve their [flood protection](#).

There are a number of uncertainty factors in these forecasts, for example the melting permafrost in the Arctic. Should warming become so strong (over 2 °C globally) [\[9\]](#) that it begins to thaw on a large scale, sea levels will likely rise much more, as the warming is likely to be self-reinforcing and the glaciers would melt ever faster.

Furthermore, the oceans and plants absorb a lot of the greenhouse gases that humans release, which is considered to have slowed down global warming. Since the breakthrough of industrialism, the oceans are estimated to have absorbed around 120 billion tonnes of carbon dioxide. In the fall of 2007, however, there were reports indicating that nature's ability to absorb the emissions has reached or even passed the breaking point. If this is true, the probability is high that the temperature increase will be significantly higher than [IPCC](#) calculated, which would also lead to faster sea level rise.[\[29\]](#)

When the oceans absorb the carbon dioxide, the gas turns into a weak acid, which has already led to the start of seawater [acidified](#). If warming continues, acidification is expected to continue and have very negative consequences for marine life, such as the world's [coral reef](#) strongly threatened if the process continues

Animals and plant life

Global warming can have very dramatic consequences for animal and plant life. So far, the consequences of warming on animal life have primarily been shown by more cold-sensitive species moving to new areas that were previously too cold, migratory birds arriving earlier in colder countries, etc.

A major problem in the future is expected to be tropical diseases, such as [malaria](#) and [dengue fever](#), will spread to new areas, which will increase the strain on healthcare in the affected countries. Already now, for example, dengue fever has [Latin America](#) performed at significantly higher altitudes in the mountains than before.[\[30\]](#)

If the warming becomes strong, large numbers of animal species are at risk of extinction. Many of the marine organisms will probably also become extinct due to that the sea water becomes too warm and the chemistry of the sea changes due to the acidification. The risk of extinction of many animal species is increasing not only because the temperature is rising, but also because the climate is changing so rapidly. Animal and plant life simply does not have time to adapt to climate change. Even with a warming of 2 °C, 30 percent of the world's animal species risk extinction. In the event of a very strong increase in temperature, a mass extinction greater than that is likely to occur [the dinosaurs](#) and about two-thirds of the other animal groups became extinct 65 million years ago.

In the worst case, even human existence is threatened. A galloping greenhouse effect is considered to have been the main cause of the mass extinction about 250 million years ago. It is the largest known mass extinction; at least 90 percent of all species succumbed. However, such a disaster scenario is estimated to require a global warming of at least 6 °C

Forests of the world

Like the oceans, forests around the world take up a considerable part of the carbon dioxide that is added to the atmosphere via human activities. A warmer climate is likely to lead to a sharp increase in numbers [forest fires](#) in the world.

Even more serious is that the warmer climate and reduced rainfall will lead to the forests in above all the temperate areas (where the majority of the world's forest stock is found) will be exposed to increasingly powerful attacks from various different pests and diseases that risk killing considerable parts of the world's forest stocks. In that case, this means that large quantities of carbon dioxide are added to the atmosphere, which increases the warming. A US study conducted jointly by the US Geological Survey and several universities (published January 23, 2009 in Science) suggests that forest death has more than doubled in the western United States in recent decades. The authors behind the study believe that a combination of a warmer climate and reduced precipitation is the main cause.[\[32\]](#)

However, moderate temperature increases may at least partially benefit the temperate forests as the growing season is extended.[\[33\]](#)

Rainforests of the world

Severe temperature increases would probably be devastating for the world [rainforests](#). They are, without competition, the most species-rich ecosystems in existence and they tie up enormous amounts of carbon dioxide.[\[31\]](#) If the rainforests die, the risk is very high that global warming will worsen significantly. Another effect is that an enormous number of animal and plant species become extinct and that the previously lush forests turn into deserts.

In the long term, the survival of all glaciers depends on the growth during the winter being at least as great as the melting during the summer. During the so-called [little ice age](#) around 1550-1850 the glaciers grew in size worldwide, but during the 20th century they began to retreat. Some regrowth took place in 1950-1980, but after that the glaciers around the world again had negative growth causing them to retreat.

This coincides with the very rapid global warming that has occurred since the 1980s, and the rate of melting has accelerated since 2000. Some smaller glaciers have melted away and many others are

highly threatened. Continued global warming means that all glaciers in [Himalaya](#), [Alps](#) and [Andes](#) may be gone by the middle of this century, the northern and central Andes even faster.

Initially, the melting will increase the risk of severe flooding, but once the glaciers are gone, water availability will be dramatically reduced for several billion people worldwide.

Also on [Greenland](#) since the mid-1990s, there has been a sharp increase in the melting of so-called edge glaciers on the coast. However, further temperature increases are required for the Greenland ice sheet to start melting. When or if that happens, it will take time before melting is prevented, even if the temperature increase is overcome.

Bergen

In addition to melting glaciers, climate change is expected to have several other effects on the world's major mountain ranges, which are also home to roughly 10 percent of the world's population.

In the last 30-year period, it has been established that the warming in [Alps](#), [Himalaya](#), [Andes](#), [Rocky Mountains](#) etcetera goes significantly faster than the average in the world.[\[17\]](#)[\[34\]](#) The vegetation zones will gradually creep upwards, which affects animals and plants that thrive at high altitudes the worst.

In the tropics, diseases that previously only appeared at lower levels will appear at increasingly higher altitudes

Positive effects

In large parts of the world, climate change risks having catastrophic effects. But if you manage to limit the average global warming to a maximum of 2 degrees until the year 2100, at least the northern countries, for example [Sweden](#), get to enjoy several positive effects.

If the average temperature rises just one degree compared to today's level will [Skåne](#) to have a climate much like central Germany today. A warmer climate will lead to a longer growing season, which would benefit both agriculture and forestry throughout the country.

Apart from the Nordic countries, the same applies in, for example [You have](#) and [Russia](#).[\[33\]](#) It is likely that the tourism industry in the Nordic region would also receive a boost, as for example many southern Europeans are expected to relocate their holidays to northern Europe to avoid the (probably) extreme summer heat around the Mediterranean which is estimated to occur already with a 1.5-2 degree increase in the global average temperature [\[35\]](#)

Among other advantages can be mentioned that less [energy](#) will be used to heat the homes and that the risk of the poor and [homeless](#) people in Russia, for example, freeze to death in winter time is decreasing.

However, it must be pointed out that in case of really strong temperature increases of 3-4 degrees or even more (global average), the negative effects will still greatly outweigh the positive ones even in the northern latitudes. For example, the number of deaths in Sweden due to heat waves will multiply, with a greatly increased pressure on health and elderly care.[\[36\]](#) Energy consumption will increase with the need for cooling facilities in the summer.[\[source needed\]](#) Throughout the year, however, the energy consumption for the indoor climate will decrease drastically