



Global Warming & Climate Change

By : Asma Rifai 7T

CIS-OBK



Hello!

I am Asma Rifai

I will be giving a presentation
of my science fair project.

Let's begin...

Background Research

What is climate change?

Climate change is a long term alteration in the average weather patterns that add up to decide Earth's local, regional and global climates. In simple words, climate change is a long-term change in global or regional climate patterns.

Nowadays, climate change most commonly refers to the increased amount of carbon dioxide in the air (produced by fossil fuels) and its effects on the environment.

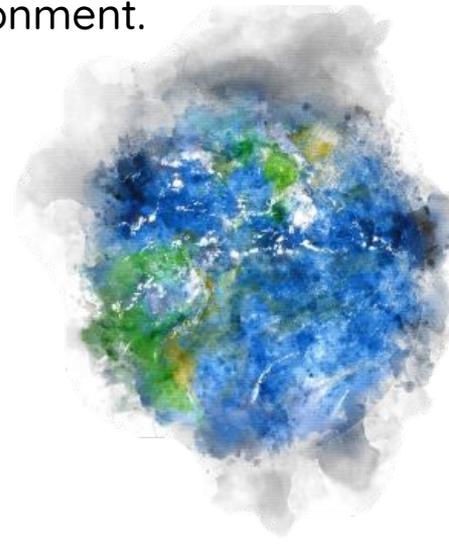


Regional Climate Change

Regional climate change describes a change in the average conditions (e.g. rainfall & temperature) in a region over a long period of time.

Global Climate Change

Global climate change describes the average changes over the entire Earth over a long period of time (e.g. rising sea levels).



Proof That Climate Change is Real



We know that global warming is happening. But how do we know? What tells us there is actually something going on with the way Earth is warming up? Scientists have found proof to show that global warming is true. These scientists are called meteorologists, who study the weather. They have kept careful records of the Earth's surface temperatures since the mid-1800s.

Surface temperatures include the temperature of the ground and also the temperature of the ocean surface.

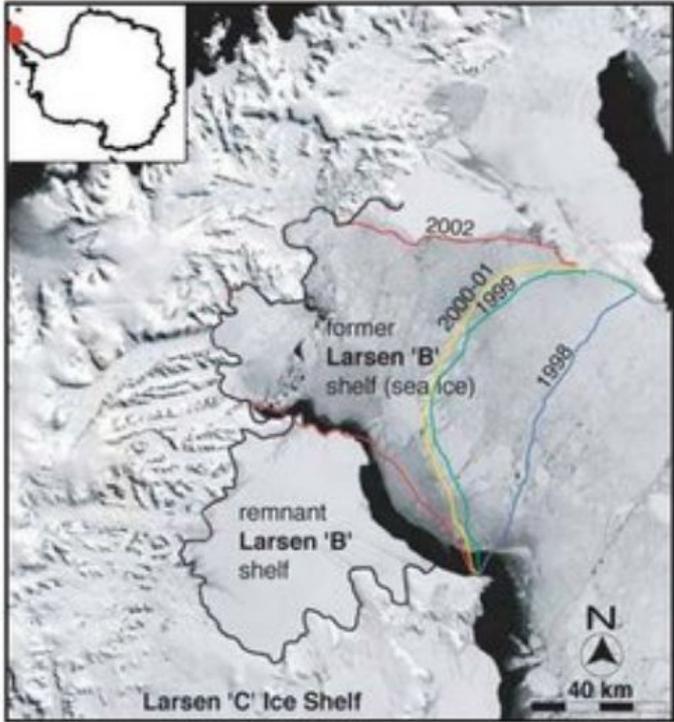
These records that the meteorologists have kept show that Earth's average surface temperature has increased approximately by 0.6 °C to 1.0 °C since the late 1800s.



More Evidence for Climate Change

Looking at old photographs and pictures can help scientists figure out more about Earth's warming. Such as the photos of particular mountain glaciers taken around the mid-1900s, which tell scientists that glaciers were much larger ages ago than their size today.

When observing glaciers in Alaska, South America, Europe and Asia, researchers have found that these mountain glaciers are melting and shrinking at a faster rate, and they believe global surface warming is at fault for this.



Melting glaciers helped cause the shattering of the 400-year-old Larsen B ice shelf in Antarctica. www.raz-kids.com

What causes climate change?

There are many points that contribute to the climate change of Earth. The main two are human activities and natural occurrences. Scientists do agree on the fact that the Earth has been getting warmer in the past 50-150 years due to human activities, (like burning fuel to power factories and vehicles). This leads the Earth to trap more heat than before, therefore warming Earth.

There are certain gases in the Earth's atmosphere that block heat inside the earth from escaping. This is called the greenhouse effect. The main greenhouse gases are:

- Carbon Dioxide (81%)*
- Methane (10%)*
- Nitrous Oxide (7%)*
- Fluorinated Gases (3%)*

(* -Percentages may not add up to 100% due to independent rounding.)

-Percentages as of 2018)

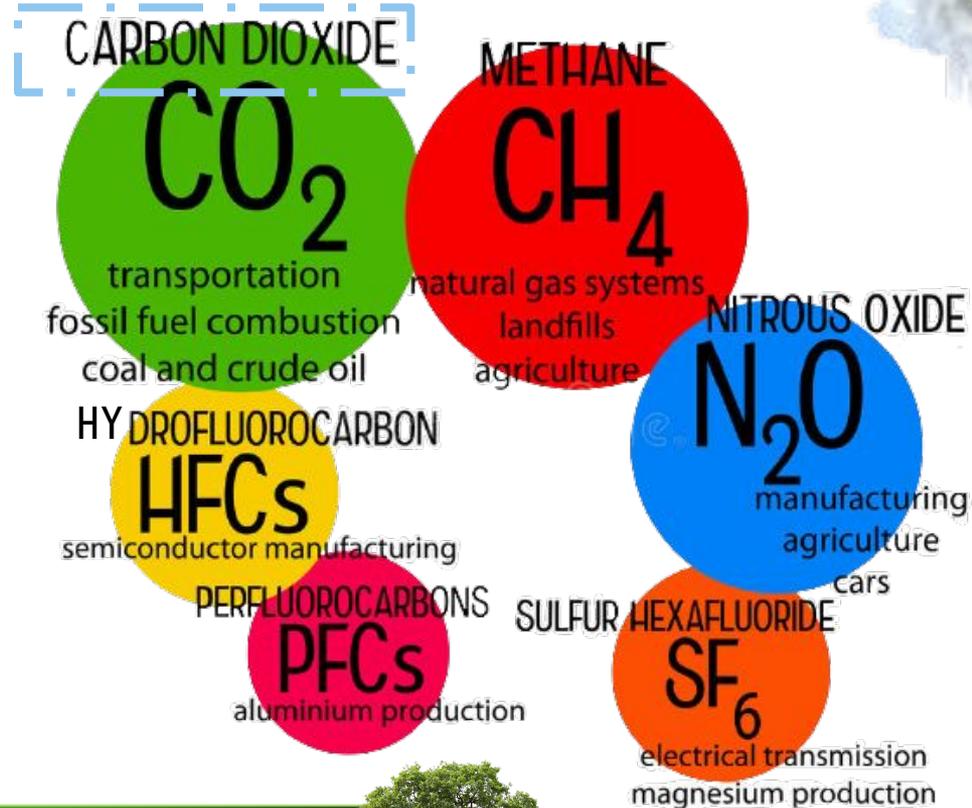


How Greenhouse Gases Affects Earth

Carbon Dioxide:

Carbon dioxide is responsible for 81% of all greenhouse gas emissions. Carbon dioxide is all over the planet - it is in plants, in the soil, in Earth's crust and in us. We release carbon dioxide into the atmosphere as we breathe, but also by other activities we do. Carbon dioxide is emitted through burning fossil fuels (coal, natural gas and oil), cutting down trees (which are supposed to breathe in CO₂), and destroying wetlands (which absorb CO₂). The greenhouse effect is a natural part of the way Earth functions. Without it, Earth would be too cold for liquid water or life. But scientists believe that the increased amount of CO₂ being emitted into the atmosphere is warming the Earth faster than it should be. Today, the Earth contains 42% more CO₂ than it did before the Industrial Revolution.

To reduce the excessful amount of CO₂ in the air, the action of planting more trees is urged.



cont...



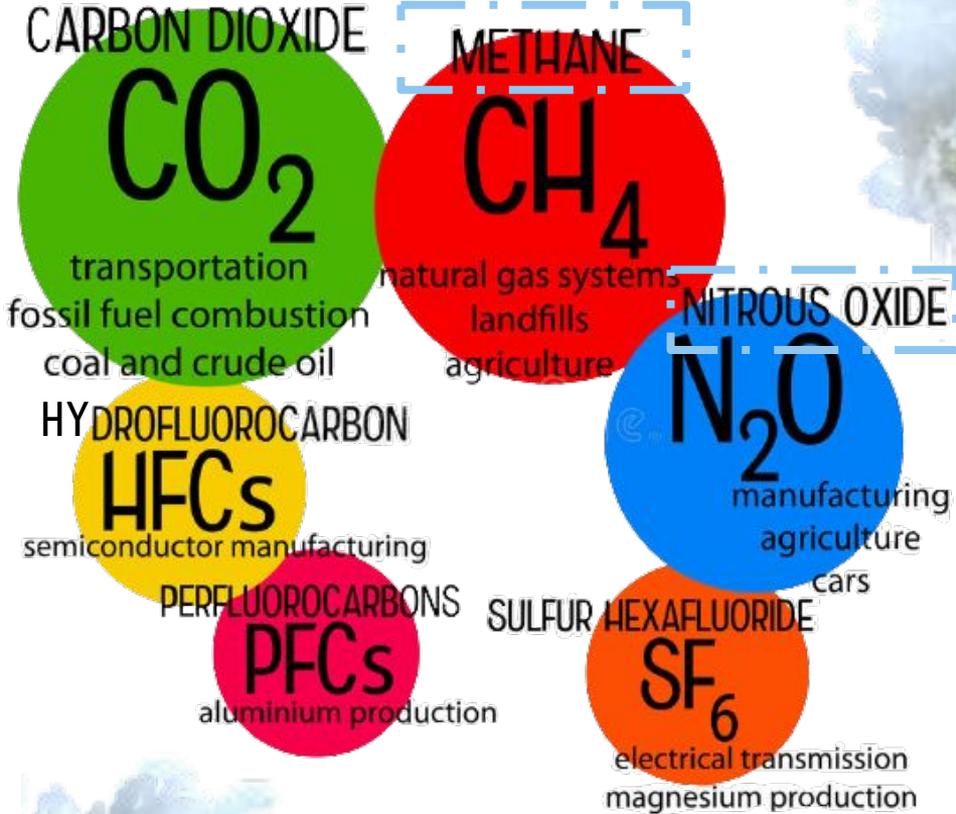
Methane:

Methane is responsible for 10% of all greenhouse gas emissions. It is emitted and enters the Earth's atmosphere during the production of coal, natural gas and oil. Methane is also emitted from livestock and other farming methods when organic waste in local manure landfills start to decay/decompose. Methane stays in Earth's atmosphere for about 12 years.



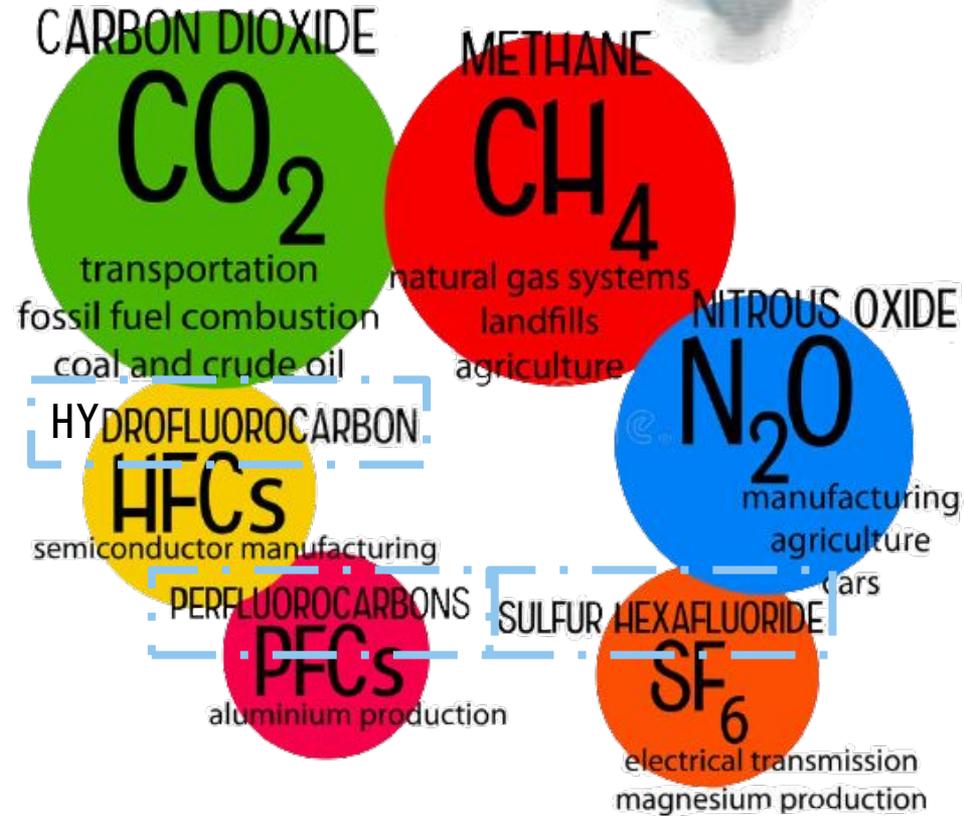
Nitrous Oxide:

Nitrous oxide has the heat-trapping power 300 time that of CO₂. Nitrous oxide destroys the ozone layer, but has a short life span. This means reducing it could have a quicker, better impact on global warming. Nitrous oxide enters the earth's atmosphere mainly from agriculture, food and industrial works. They can also be emitted when fossil fuels & solid waste are burned, when wastewater is being treated, and from chemical reactions in soil and the ocean.



cont...

- Fluorinated Gases:
Hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride are called fluorinated gases. They are emitted during many kinds of industrial processes. They are also called F-gases or High Global Warming Potential Gases. Usually these gases are used as substitutes to take away substances that cause damage to the ozone layer, but they are powerful greenhouse gases. Their global warming effect is up to 23 000 times greater than CO₂! Their emissions have been rising rapidly.



Is Climate Change Natural too?

As stated earlier, there are many points that contribute to the climate change of Earth. The main two are human activities and natural occurrences. I have researched about human activities, and now it's time to dig deeper into the natural occurrences of the Earth...

Some scientists say that global warming doesn't have to be caused by human activities, because global warming and global cooling have happened repeatedly even before people started to burn fossil fuels and cut down trees. Scientists say that Earth's atmosphere used to look a lot like Venus when it first formed. There have been several ice ages during the past hundreds of thousands of years. Ice ages are when Earth's surface was covered in ice. There have also been warm periods in between these ice ages.

The Earth is Forever Changing

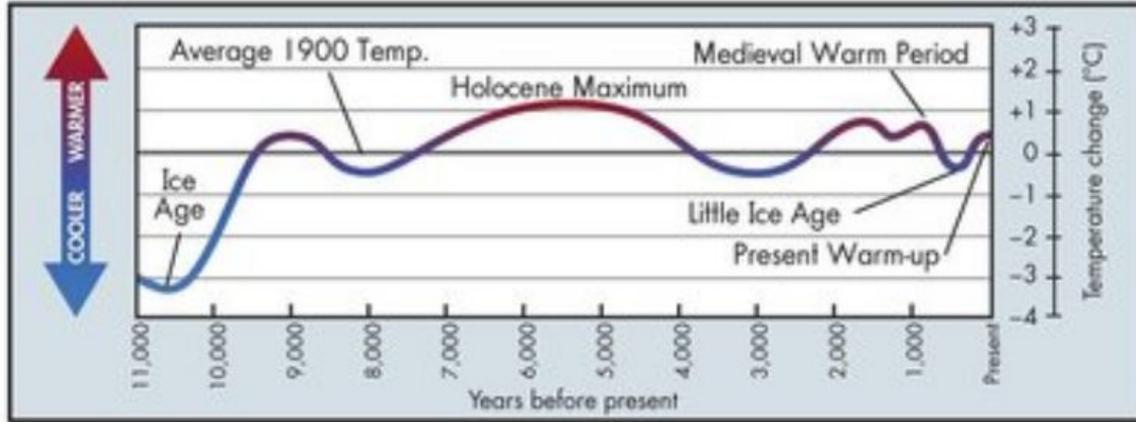
4.6 billion years ago



Today



Through Time: Ice Ages & Warm Periods



According to geologists, the last ice age ended 11 700 years ago, and we are now in a warm period in between two ice ages.

This graph is based on weather records and scientific evidence, to show the years before in time and Earth's average global temperature at those times.

In Europe, the climate cooled between the 'Medieval Warm Period' (~1100 to ~1300) and the 'Little Ice Age' (~1400 to ~1800). The climate started warming again after the 'Little Ice Age' ended.

Since these earlier climate changes had natural causes, some scientists think that maybe today's climate change & global warming has *some* natural causes as well.

Observation: By looking at the graph, I noted that the Earth's climate went significantly up around 11 400, (or the Ice Age) and did not cool down back to that level after.

Discovering Earth's History

Remember when I mentioned that meteorologists have kept careful records of Earth's temperature since only the mid 1800s? Then how do they know about the earlier climates and temperatures of Earth, from hundreds and thousands of years ago? Magic?

Nope! These scientists, called paleoclimatologists, have many ways of figuring out what the world used to be like thousands of years ago. These ways include:

Studying old trees' growth rings : Paleoclimatologists can get a lot of information about the climate and Earth's temperature was like hundreds of years back, just by looking at old tree rings. If the climate was wet & warm, those rings would be thicker, and if the climate was cold & dry, those rings would be thinner.



Examining ice cores : Ice cores are long cylindrical pieces of ice that are drilled out of glaciers and ice sheets (e.g. in Antarctica). They carry chemical evidence about Earth's atmosphere & climate activity. The ice core will be deeper if it formed earlier. Paleoclimatologists can discover temperature shifts, precipitation, volcanic activity, wind patterns, & the atmosphere from thousands of years ago by studying and examining at these ice cores.

cont...

Analyzing Coral Reefs : Most coral reefs have been alive from millions of years ago, but they are very sensitive to changing climates. So this means studying coral reefs can give paleoclimatologists big clues on what the ocean was like in the past. Corals form skeletons as they grow, by taking calcium carbonate from the ocean water. The density of these calcium carbonate skeletons depends on the water temperature, light & nutrient conditions, which changes over time. This creates growth rings on the corals alike to the ones you'd see in trees. Paleoclimatologists can analyze these rings to gather information.

Looking at Speleothems : Speleothems are pillars of stalactites & stalagmites. They are formed because of rainwater. During Earth's early water stages, the rain was acidic. When this acid rain went through the soil, the extra minerals formed stalactites & stalagmites, forming pillars that we now call speleothems. Scientists can study these to find out more about the climate in Earth's early years.

There are many other ways, other than listed above, that paleoclimatologists can find out about the Earth's climate conditions years ago. For example, studying sedimentary rock layers.



A coral reef



Speleothem cave



Sedimentary rocks

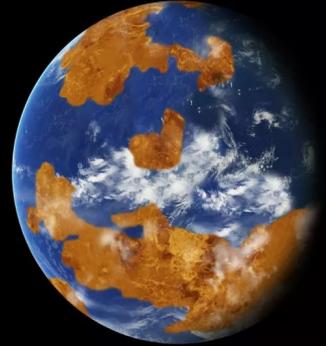
Climate Change on Other Planets

Some scientists say that Venus and Mars may have been able to hold life billions of years ago, but factors like the distance of the Sun, orbital distances, and imprecise rotation periods lead our neighbor planets to uninhabitability.

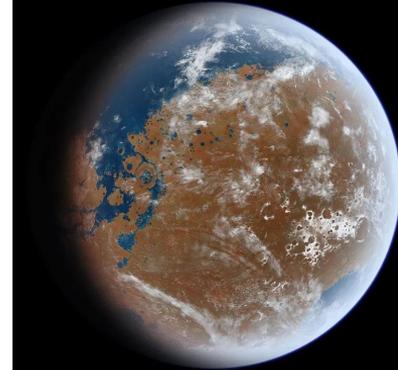
Venus, as you may have heard, is often called Earth's evil twin. But there is a reason to this nickname. Scientists think that Venus used to be earth-like when our solar system first formed. But greenhouse gases soon took over and boiled Venus water. Because of Venus's close distance to the sun and its extreme amount of volcano eruptions, Venus was only able to have a chance for life for 200 million years, and is now a fiery, rocky ball to remind us of the effects of greenhouse gases.

Mars, on the other hand, was also formed with water on it. Since it was farther away from the sun, greenhouse gases actually helped the red planet to warm up to having water bodies. But Mars had a weak magnetic field, so solarwinds took over and created too much air pressure. This large amount of air pressure killed off any kind of life that may have been alive, and froze the water into ice. Mars had a chance for life for 1.5 billion years before it came to an end. Today, Mars is a cold, barren, rocky planet; nothing like it may have once been.

Venus with water



Mars with water





Question

Problem?

If Earth has warmed and cooled naturally, why are scientists so concerned about today's global warming?

Hypothesis

I think scientists are worried about today's climate change because if the earth warmed up super high and at fast speed, because of human activities, humans would become extinct. Climate change isn't just about Earth, it's also about our chance for survival.

And this is probably why scientists are freaking out about global warming and climate change.



Research

History of Earth's Climate Change

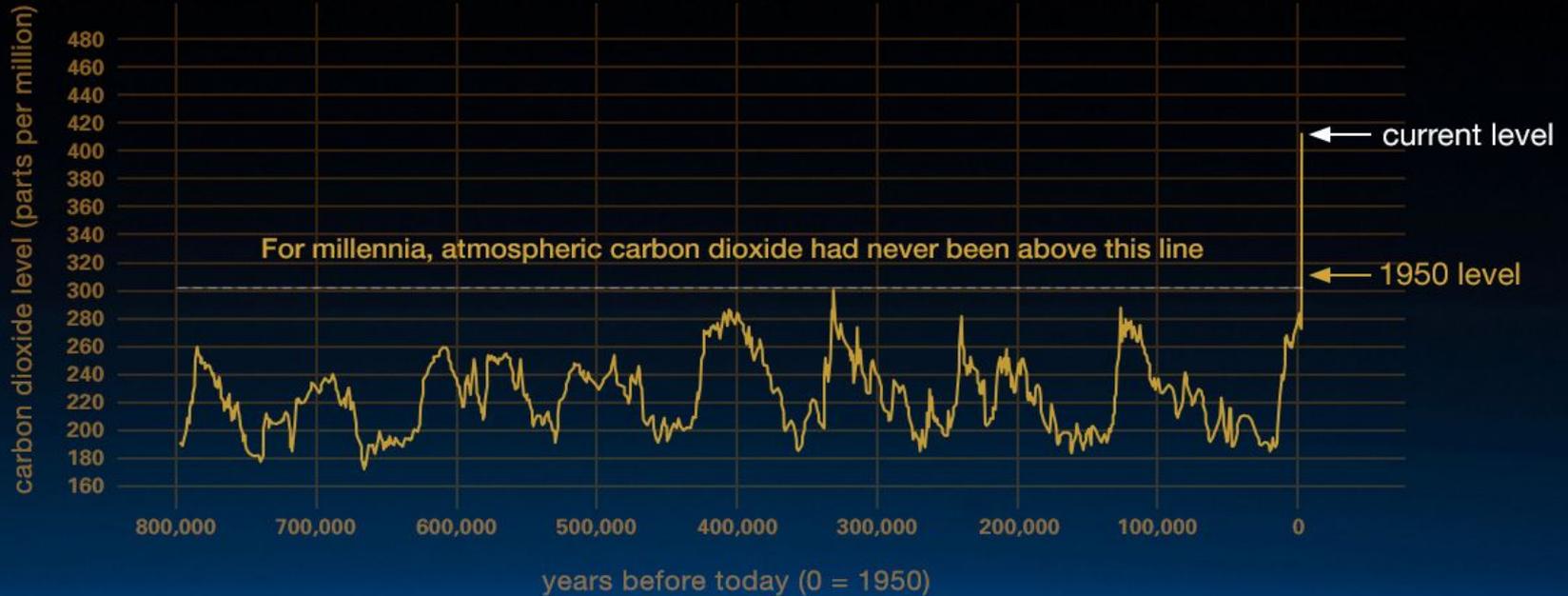
In the past, Earth underwent climate change without our help. We know this because of evidence paleoclimatologists have found. Before the Industrial Revolution, Earth's climate change was due to natural causes such as:

- **Sunlight Variations:** Over time, alterations of the sun have increased and decreased the amount of solar energy reaching Earth.
- **Earth's orbit:** Sometimes, earth wobbled a tiny bit during its orbit around the sun, which changed the time and place of sunlight hitting Earth.
- **Volcanic Eruptions:** Aerosols can cool earth's climate, are particles that reflect sunlight & brighten Earth. Volcanoes have also increased greenhouse gases in Earth's past over millions of years, which lead to global warming.

The Earth is forever changing. The same applies for its climate. In just the last 650 000 years, there have been several ice ages and warm periods. The last Ice Age ended about 11 7000 years ago. After that is what we can call the era of human civilization - or what scientists call the modern climate era.



C02 level over the years before Human Civilization Era !



“This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO₂ has increased since the Industrial Revolution.

(Credit: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO₂ record.)”

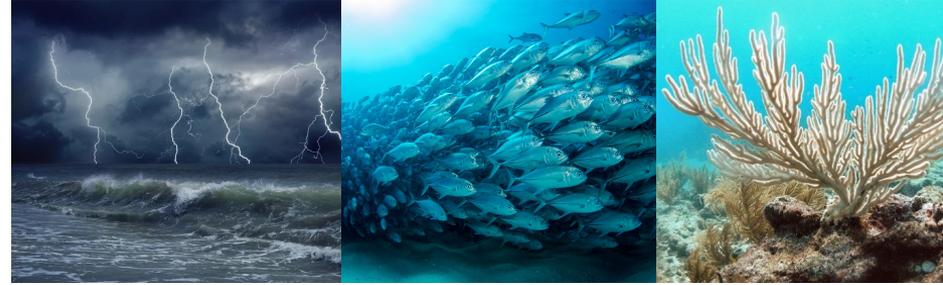
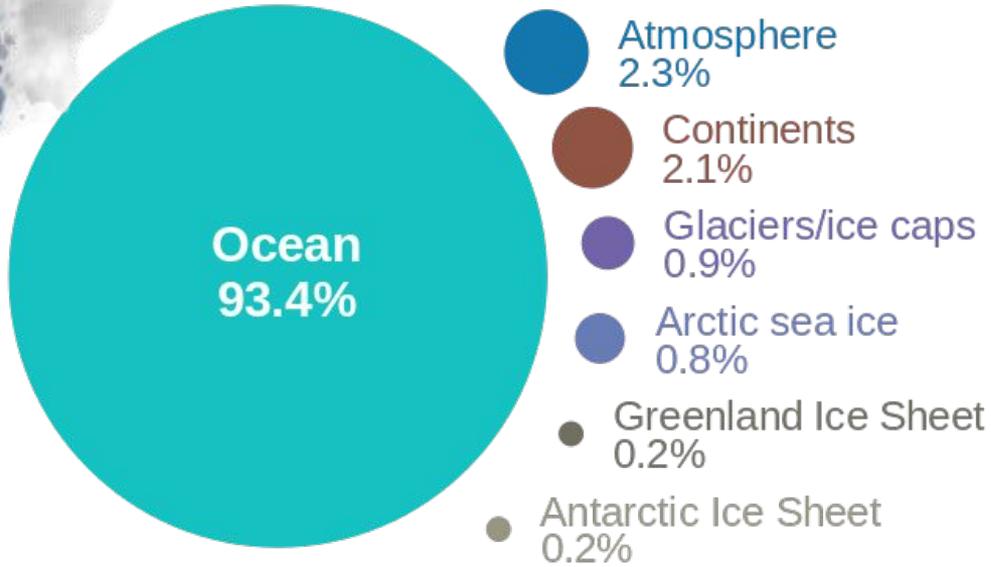
- From <https://climate.nasa.gov/evidence/>

Hasn't Earth's Climate Always Changed?

Earth's natural causes for climate change still occur today, but their influence on climate change is too small, or they happen too slowly to explain the fast warming of earth scientists have noted recently. This warming is the kind that is supposed to happen over hundreds of thousands of years, but it's happening in decades, and this simply CANNOT be natural. We can tell this because scientists closely monitor natural, as well as humans' activities that influence climate, with satellites and meteorological stations. Paleoclimatologists found evidence shows that, "Today's current warming is occurring roughly 10 times faster than the average rate of Ice-Age recovery warming. Carbon dioxide from human activity is increasing more than 250 times faster than it did from natural sources after the last Ice Age." (- from NASA GLOBAL CLIMATE CHANGE - Vital Signs of the Planet).



Where does global warming heat go?



Global warming is affecting the polar regions, the Earth's atmosphere, & our continents, but the most highly affected place is the ocean. Oceans were 0.17 °C warmer in 2017 than in 2000, and they keep warming. More than 90% of global warming occurred in the world's oceans since 1950.

Many coral reefs (and Great Barrier Reef) are dying from coral bleaching due to rising ocean temperatures. As a result, all the life in these coral reefs are dying as well. Ocean warming affects marine mammals & fishes by taking away their breeding grounds, which lessens their populations.

Fish are migrating towards the Poles, due to ocean warming, this interrupts fisheries. Rising sea levels are drowning wetlands, coral reefs and seagrass meadows into the ocean. The ocean today absorbs $\frac{1}{3}$ of CO₂ & oxygen we produce, but it is resulting in ocean acidification.

Climate Change & Rising Sea Levels

Scientists have found evidence (through satellites capturing pictures of Earth), that ice around the North & South Poles are shrinking. They discovered that between 2004-2005, a large chunk of ice, as big as Texas disappeared in the Arctic.



In the South Pole, satellites revealed that ice sheets & ice shelves in Antarctica are melting.

All of this ice melting can contribute to the rise of global sea levels.

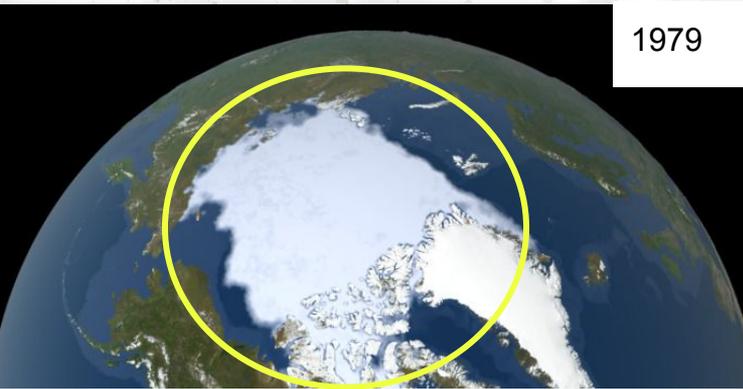


The melting ice in the Arctic ocean is risking the lives of polar bears. Polar bears need ice floes to stand on for catching fish.

But scientists said in 2005 that the number of ice floes are decreasing, which means less polar bears.

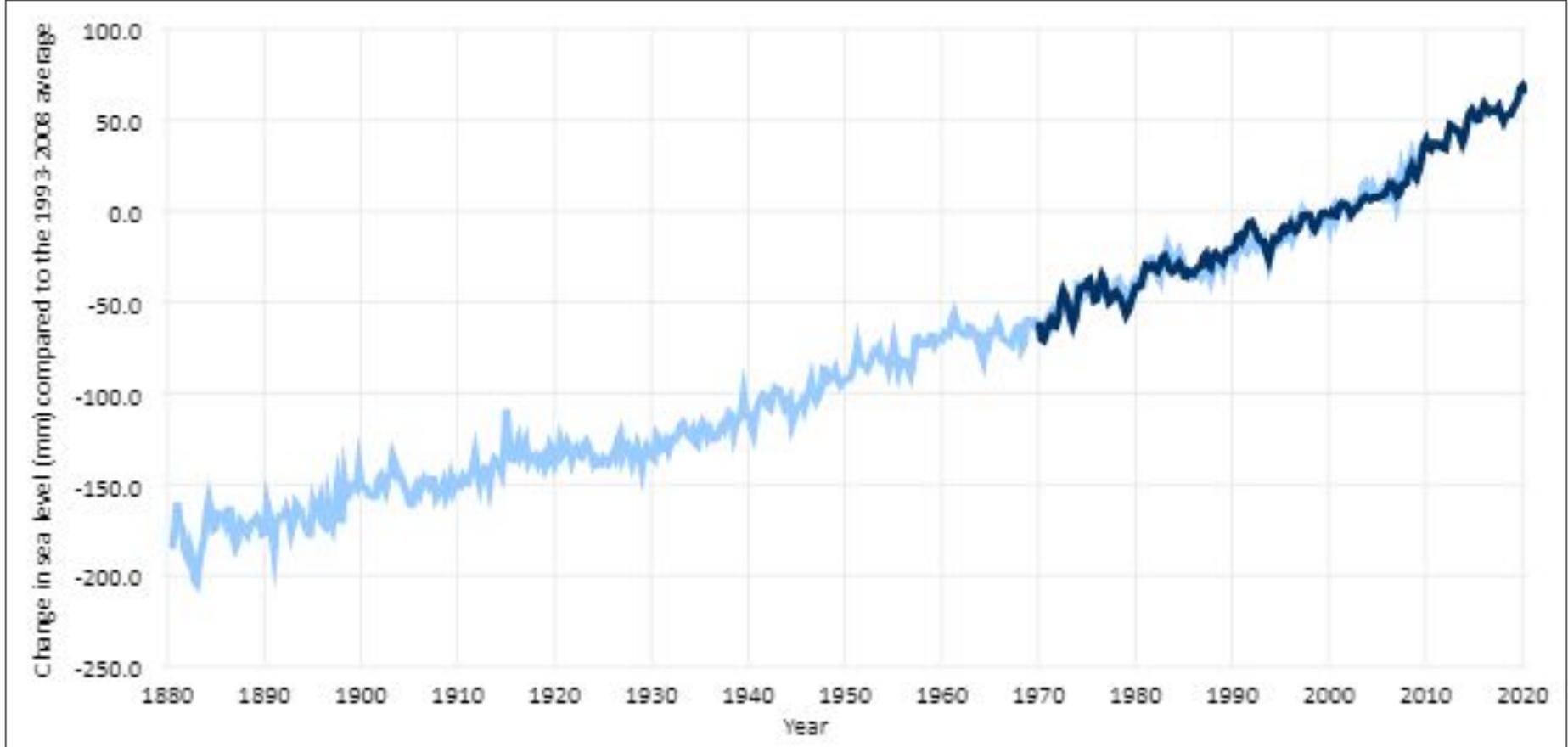


Antarctic ice sea minimum since 1979-2020



Global sea level since 1880

According to this graph, the global average sea level has increased by 21-24 cm in the past 2 ½ decades.



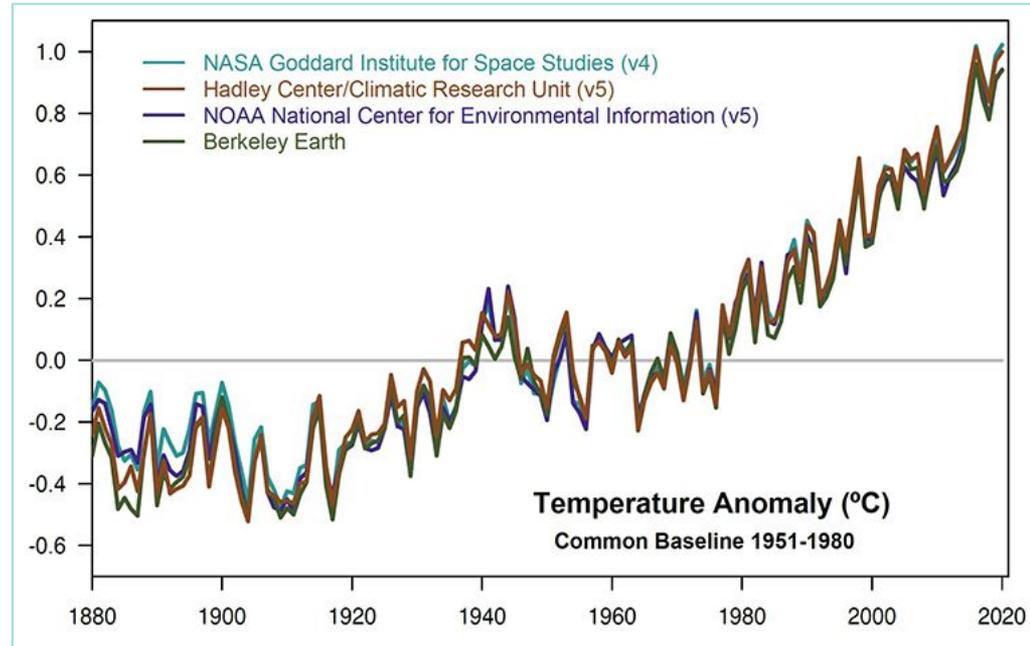
"The light blue line shows seasonal (3-month) sea level estimates from Church and White (2011). The darker line is based on University of Hawaii Fast Delivery sea level data." - <https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>

Climate Change - Now Faster Than Usual!

The graph on the right shows the increase of Earth's climate temperature from 1880-2020. According to data from NASA, the years 2016 and 2020 are tied for the warmest years we've had since 1880. The 7 warmest years in this record have occurred in the recent 10 years.

The Intergovernmental Panel on Climate Change (IPCC) says, "Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

The IPCC estimates that natural factors (separately) in global warming actually lead to a slight *cooling* over the past 50 years (which hasn't been very noticeable), while humans are responsible for 47%-146% of today's global warming.



Graph Image - Credit: NASA's Goddard Institute for Space Studies.

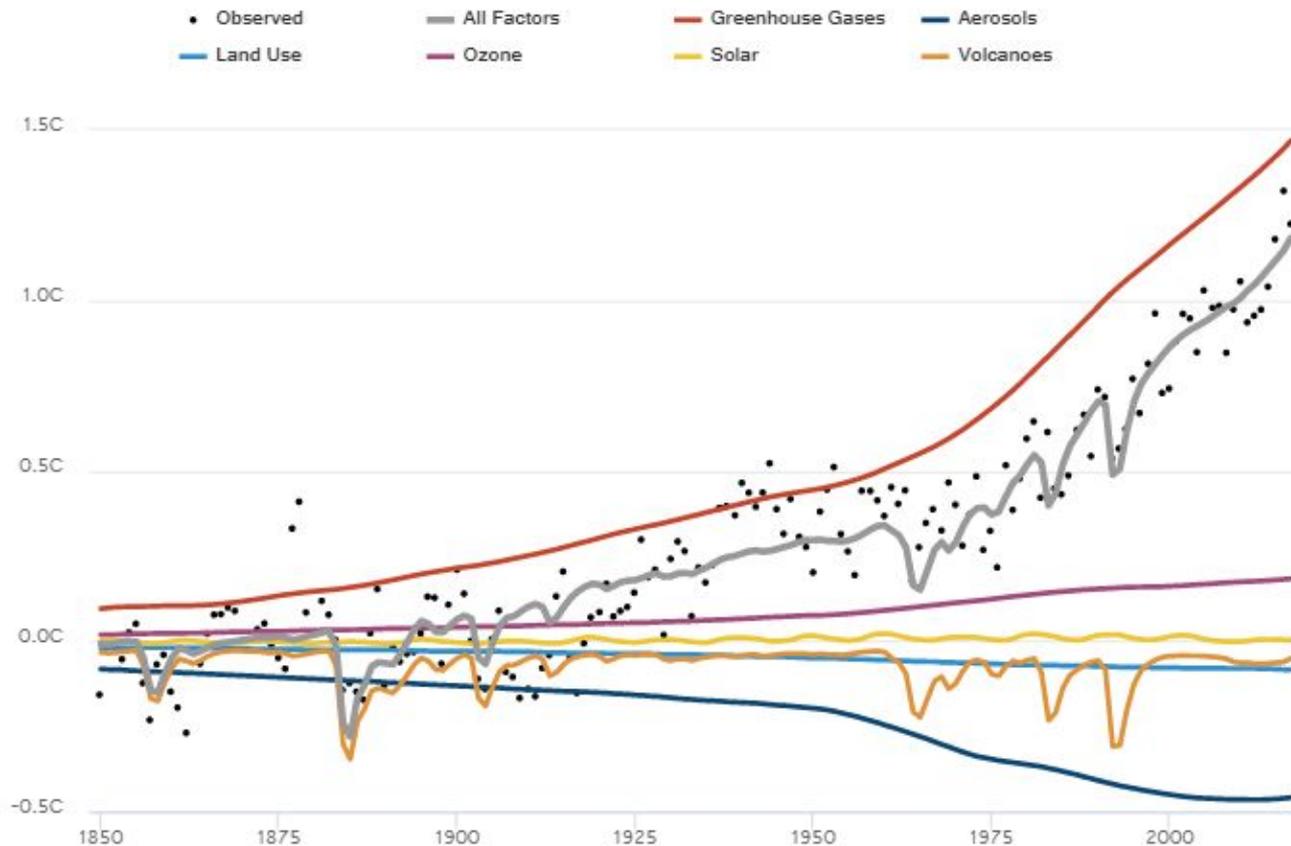
Factors that Change Climate Change

Scientists measure many factors that affect the amount of energy entering and remaining on the earth's surface. These factors are called radiative forcings. Radiative forcings include greenhouse gases and aerosols.



But if only greenhouse gases were warming up Earth, we would've seen $\frac{1}{3}$ more global warming than what has already happened. But atmospheric aerosols remove some (not all) of the extra greenhouse gases. They reflect solar rays that reach Earth and increase heat reflecting clouds which cools our planet. Aerosols can be natural, when they come from volcano eruptions - or they can be artificial substances, like particulate air pollutants and smoke. In 2020, scientists were thinking of spraying sulfate aerosols in the sky to reduce climate change temperature levels, but this can have a very negative effect. Aerosols are naturally produced when a volcano erupts, but spraying them artificially can disturb the natural air currents around the world. The scientists say, "Spraying aerosol in the northern hemisphere would lead to cyclones in the North Atlantic. In sub-Saharan Africa and parts of India, the process could create severe drought."

Global temperatures: Human and natural factors, 1850-2017



This chart shows the average global surface temperatures (black dots), and modeled influence of different radiative forcings (colored lines), as well as the combination of all forcings (grey line) from 1850 to 2017. Credit: Carbonbrief

Climate Change in the Future

Climate change is a present problem. But it will be a future problem if we do not take action. Some years ago, scientists said that we only have 12 years left to limit global warming to maximum of 1.5 C° so Earth can escape a harmful climate crash. If we don't take action by then....

- Earth's sea level will rise about 2 meters by 2100
- Hurricanes will become stronger and fiercer
- Droughts & heat waves will increase
- Health risk as diseases will spread faster
- Precipitation patterns will change
- Summers season will get longer
- Temperature will keep rising
- Hunger & water crisis will worsen around the world

The effects have started and will continue. 15 000 scientists from 184 countries have said we must take action in the next 7 years to reduce climate change effectively.



Climate Change & Bees

Honey bees are clearly essential parts of our ecosystem. They are highly effective pollinators of our food crops and also for wild plant life. We need bees to keep our crops and Earth healthy, but recently, due to climate change effects, their numbers have been declining by billions!

As global temperatures continue to rise, the North American and European honey bee ranges are getting smaller. According to ACCLIMATISE, bees in their most southern habitats are dying due to high heat, and in their most northern habitats, they are remaining mostly inactive, so their range is shrinking. Recently, bees are becoming more prone to disease. Changes in weather patterns due to climate change also affects the bee population.

Without bees, the accessibility and variety of fresh produce would decline significantly, and human would suffer from nutritional deficiencies. Crops that wouldn't be worthwhile to hand/robot-pollinate would likely be lost.

Albert Einstein had said, "If the bee disappeared off the face of the earth, man would only have four years left to live."



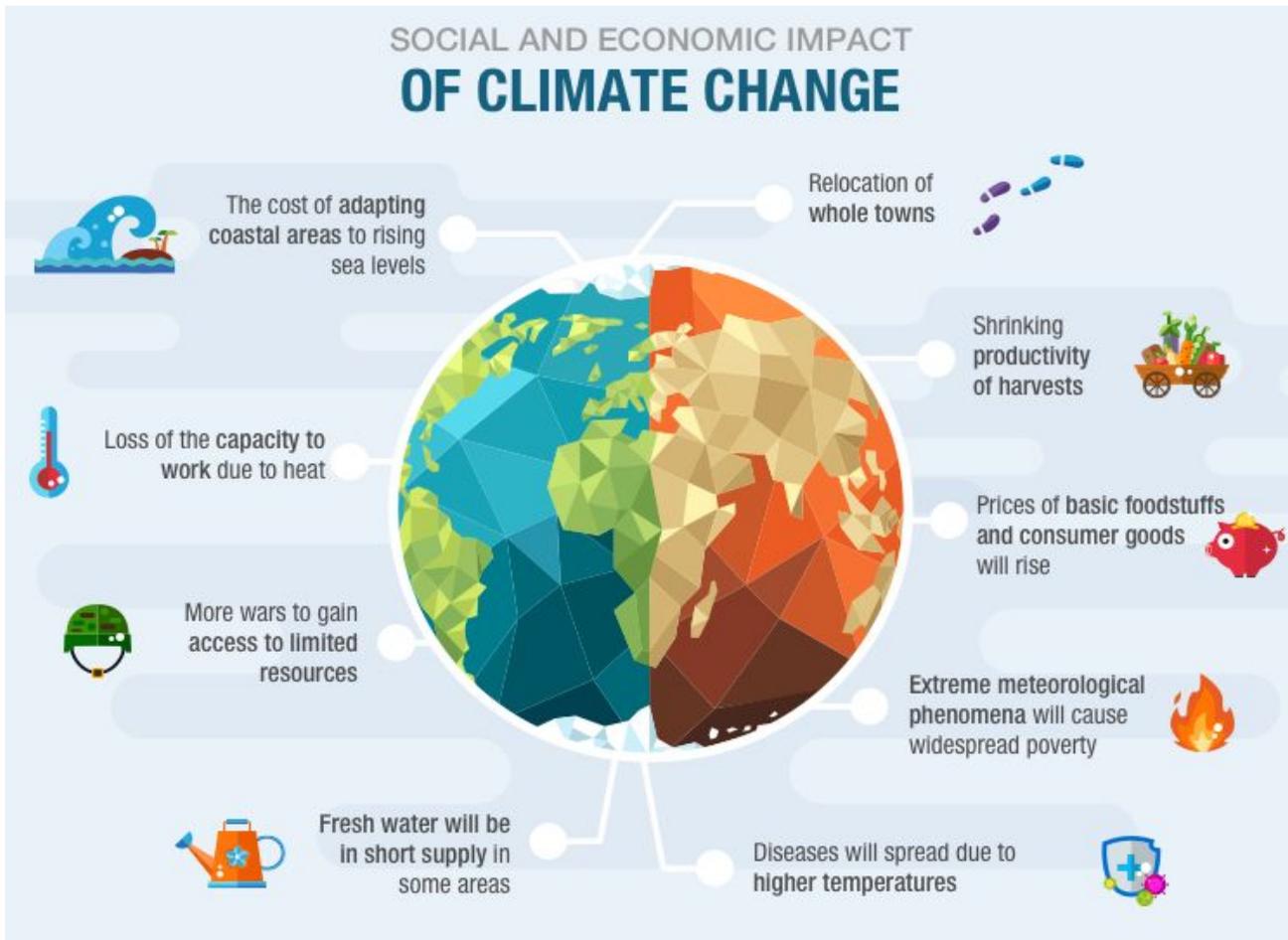
Pandemics & Global Warming

When COVID-19 hit the whole world in 2020, some people misunderstood that nature was finally “getting a break” from humans. However, this is not the case. Many effects of COVID-19 will have negative impact on the environment. Before the pandemic started, grocery stores would advertise reusable shopping bags, but this is not encouraged any more due to Covid-19. Disposable masks can greatly increase the amount of waste we make. If everyone used disposable masks daily, the world would have more than 7 000 000 000 masks wasted each day.



So how can global warming start pandemics? Well, global warming causes warmer weather, which makes it easier for infectious diseases to spread faster. One way that diseases spread are through animals. It is estimated that roughly 60% of pathogens come from animals. When climate change alters and warms up the habitat of certain animals who cannot adapt to it, they move to different areas. This is where pathogens living in animals/insects can jump to new hosts and cause brutal pandemics. Biodiversity makes an ecosystem healthy. But scientists say that in the future, there will be more and more pandemics because a major cause of biodiversity loss is climate change. Global warming also leads to food & water shortages. Without proper nutrition, disease can spread faster.

Effects of Climate Change on Humans



Pollution & Global Warming

What's the connection between pollution & global warming?

When greenhouse gases deplete Earth's atmosphere, it allows the sun's powerful rays to warm Earth.

PLASTIC POLLUTION:

Plastic is one of the longest living pollutants. It creates greenhouse gases in every step of its lifecycle.

Researchers said that the production and incineration of plastic will account for 2.8 million tons of greenhouse gas emissions by 2050. Microplastics destroy plankton, which are tiny organisms responsible for absorbing extra CO₂ from the atmosphere into the water.

AIR POLLUTION:

Air pollution doesn't only cause global warming, it worsens it.

Air pollution, from factories & incinerators, rise with large amounts of CO₂, methane, and other greenhouse gases.

The greenhouse effect takes place, and BOOM! The world gets warmer.

WATER POLLUTION:

When ocean temperatures rise due to climate change, this affects many marine life. Coral reefs are very important to the ocean.

Along with plankton, they provide oxygen to many species of marine life, and 50% of Earth's oxygen produced is from plankton.

But global warming is threatening the sealife and the coral reefs.



cont...

The developed countries of the world cause global warming mainly because of industries. Developing countries around the world who cannot provide enough to meet everyone's needs cause global warming too - by littering and pollution.

Polluted waters in developing countries are a result of throwing trash and even human waste directly into it. Because of this, the waters smell and the life in them dies away. Meanwhile, waters in industrialized countries are polluted due to chemicals and toxins spilled into the water. And don't forget the plastic by the beaches! This plastic affects ocean life & kills them. The Great Pacific Garbage Patch floating out there is about 1.6 million sq km, 3 times the size of France!

There is more air pollution in developing countries, a result of not having the technology to and resources to fight air pollution. The laws are not applied or brought up. Emission standards aren't in place. Most of the time, in poverty-stricken countries, the education is also less. On the other hand, air pollution in developed countries is mainly from industries and the large amounts of fossil fuels being burned. Ships (that are used for exports, etc.), have a bad environmental impact and are responsible for more than 18% of some air pollutants.



Conclusion

According to my research studies, I found out that my hypothesis was correct...because today, climate change & global warming is happening faster and higher. This has never happened in the history of Earth's climate change; it took thousands of years for Earth to warm up 3 to 5 °C more. But we could witness this in only 80 years, if we keep emitting greenhouse gases at the rate we do nowadays. Humans are misusing, overusing and wasting of natural resources. In addition to that, increasing global population leads to more deforestation, industrialization, fossil fuel usage and more pollution. Already, there are many bad effects like pandemics, other life-threatening illnesses (e.g. cancer), natural disasters (earthquakes, hurricanes...), water scarcity and food shortage. Without water, any living things wouldn't survive. Even if Earth turned back to normal after this global warmup, we humans wouldn't be here, we'd be extinct because of global warming in the past

Also, the effects of climate change lead to less and less proper resources to sustain life on our planet. In the end, earth will slowly die.

Solutions



Saving The Trees

What do trees do for the Earth?

- Filter the air and remove excess CO₂
- Help reverse climate change by balancing the amount of CO₂ & oxygen in the atmosphere
- Store carbon in themselves and the soil
- Reduce amount of stormwater runoff, this reduces erosion, flooding and pollution risk
- They are a necessary part of a healthy environment.

Given some of the many benefits of trees, they are a very important factor in saving Earth from becoming a greenhouse gas-stricken Venus. Many nations around the world have realized that the natural diversity of their environment are crucial for maintaining a proper climate. There are various tree planting organizations across the globe, and many programs that urge the need of more trees in today's air pollution-increasing world.

cont...

What are countries around the world doing about trees?

- In the Philippines, a new law was passed in the middle of 2019, stating that every student must plant 10 trees if they want to graduate, from elementary school students to college students. The Filipino government believes it is a good way to preserve the natural environment of the Philippines while giving youth an opportunity to take part in action for climate change and build a greener environment for their future. They also estimate that this generation will plant 525 billion trees, which means 175 million trees planted each year.
- In Norway, deforestation is banned, as a way to protect and greenify the environment.
- Bihar, a state of India, banned deforestation (except for on private lands) in 2019.
- In China, in 1978, a tree planting program called the Green Great Wall was started and will continue until 2050. According to its government, China has planted more than 66 billion trees since the project began. The project was put in place to battle the desertification expanding into China's



cont...

➤ Pakistan's Prime Minister, Imran Khan, has a long history of encouraging environmental restoration. In 2017, Khan set a campaign to plant 1 billion trees in Khyber Pakhtunkhwa Province, and the goal was reached earlier than expected. In December of 2020, the government rolled out its first phase of the new tree planting project, (to restore Pakistan's forests), and is planting 3.25 billion trees. The Prime Minister hopes this number will reach 10 billion by 2023, the end of his term in office. As of this year, Khan has launched urban forestry for 50 places in Lahore; his post was discovered on Facebook.

New studies estimate that by establishing a global tree-planting program, two thirds of greenhouse gas emissions from human activities could be removed from the atmosphere today. Scientists say,“(By planting more than a half trillion trees) We could capture about 205 gigatons of carbon, reducing atmospheric carbon by about 25 percent.”

All Posts People Groups Photos Videos

 **Imran Khan** ✓
5d · 🌐

“I have launched urban forestry on the lines of Miyawaki technique in Japan where the trees grow 10 times faster and 30 times denser and is the best way to fight pollution. 50 sites have been chosen in Lahore. First experiment was in Liberty roundabout in 2020.”
[#PMIK](#)

BEFORE
JAN 2020

AFTER
FEB 2021



🏠 🛒 📍 1 🏠 🔔 ☰



“Action for Water Pollution

During the 1800's, the Thames River in London, England, was the most polluted river in the world. It was putrid, foul-smelling, and brown coloured. Sewage and waste would be discharged right into it, and people continued to bathe and drink from it. Several thousands died due to cholera from the polluted river. Then, between 1861-1960's, treatment plants & laws were enforced to clean the Thames River. Today, it is the cleanest river in the world!

From this incident, countries like Indonesia (Citarum River), India (Ganges and Yamuna Rivers), China (Yellow River), the U.S. (Mississippi River), Bangladesh (Buriganga River), (and more) who have polluted rivers can realize that the conditions and cleanliness of nature & Earth depends on humans' actions.



Indonesia's Citarum River is the most polluted river in the world today. Everyday, about 20 000 tons of waste (especially plastic and textile material) are thrown into this river, which used to be a freshwater source for 80% of Badung, a city in Indonesia. The lead level contained in Citarum River is 1000 times the U.S. standard amount. In November of 2020, the Indonesian government said it decided to start a 7-year clean up program for the Citarum River, hoping to make its water pure and drinkable by 2025.

“Action for Air Pollution

Copenhagen, Denmark, is famous for having more bikes than people & cars! There are 675 000 bikes and only 120 000 cars. Out of the whole population in the city, 62% bike to work/school, and only 9% drive. There are over 100 bike centers in the city, and Copenhagen is thought to become carbon- neutral by 2025. Its home country, Denmark, is also the 2021 (and before) cleanest country in the world.



Bikers in Copenhagen

Denmark has reached the honor of being the cleanest country with some great effort. The country has some serious policies to reduce greenhouse gas emission & prevent climate change. What can we learn from Denmark? As an industrialized country, Denmark focuses on eco-friendliness, sustainability, healthy living at the same time. Denmark encourages this with eco-friendly hotels, solar-powered boats, and organic food.

All other countries (especially China, India, Pakistan, whose air is most polluted in world, even during the day time) should take Denmark as a role model. Earth is everyone's responsibility, and the developed countries must play a larger role because they have the resources to do so. Earth's atmosphere is the air around us, so we must keep it as pure as possible to tackle global warming.

Montreal Protocol

The Montreal Protocol is aimed at improving air quality. It was carried out in 1987 as a global plan for protecting the stratospheric ozone layer. It forbids industrialized countries and (from 2004) developing countries to produce/consume substances responsible for the destruction of stratospheric ozone. Protecting ozone layer can have a positive outcome, as the ozone layer plays a role in cooling the effect of greenhouse gases which decreases climate change.



Canada's Plans For a Greener Future

Canada is putting some new policies in place to help tackle global warming. The government plans to:

- ❖ Implement carbon tax
- ❖ Replace diesel public transport vehicles with electric trains
- ❖ Encourage carpool
- ❖ Increase bike paths
- ❖ Promote renewable energy sources to limit CO2 emissions
- ❖ Close most coal power stations

“Lights... Camera... Recycle!”



Sweden is the 8th cleanest country in the world. It is known for its sustainability, low CO2 emissions, the use of renewable resources and increasing its greenery. Moreover, it is the country that actually imports trash!

Every year, Swedes recycle 1.8 billion plastic bottles that would have ended up in landfills and water bodies. Recycling is a law, and must be sorted at home into 7 categories of trash/recyclables, before ending up at the recycling center. The recycling rate in Sweden has been and still is 99%. This country is so close to zero waste, and that's why they need to import trash from other countries. Sweden incinerates garbage to make electricity, (instead of using fossil fuels) to heat 1.2 million homes! Sweden has 33 waste-to-heat incinerators, and uses the imported trash to keep it running. Sweden also converts food waste into eco-friendly biogas. Starting from 2021, food waste collection has become mandatory in Sweden, according to Swedish Waste Management Association. The biogas they produce is used to run transit buses & heat apartments.

Sweden is a professional at recycling. Countries like India, the U.S., and even Canada are large garbage producers. Just like Sweden, we should look for ways to reuse and recycle our garbage, so less of it ends up in waterways and landfills, therefore lessening the impact of global warming and climate change.

Every Action Matters

There are nations taking action for climate change around the world. Protecting Earth is our responsibility. We can't save the whole world, but we can *think globally, act locally*. Here are some ways we ordinary people can help save earth from global warming and climate change:

Take care of nature.

- ★ Start a backyard garden, this reduces your carbon footprint
- ★ Plant a tree! If everyone in the world planted 1 tree, that would be 7,874,965,825 new trees!
- ★ When in a park or a nature reserve, don't litter or walk on the grass.

Water conservation...

Wetlands, lakes and rivers hold a lot of freshwater and also store $\frac{1}{3}$ of the world's CO₂. To help protect water bodies:

- ★ Wash dishes by hand instead of using machine
- ★ Take quick showers
- ★ Don't litter near water bodies



cont...

RECYCLE:

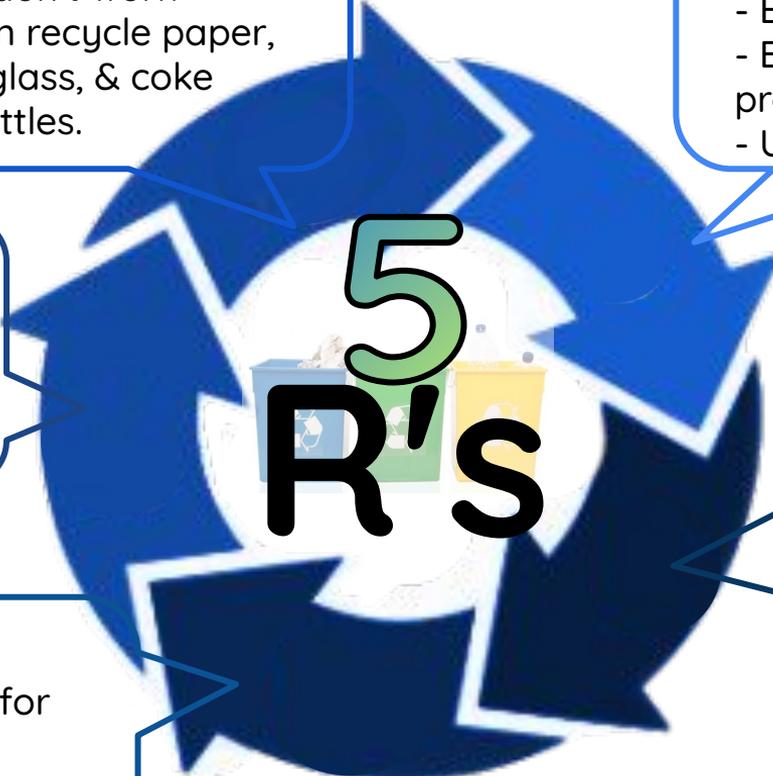
- Only if reducing and reusing don't work
- You can recycle paper, plastic, glass, & coke cans/bottles.

RETHINK :

- Think about your impact on the environment.
- Buy essentials only
- Buy less packaged products.
- Use both sides of a paper

RENEW :

- Use renewable energy whenever you can
- Use things you don't need to throw to replace



**5
R's**

REDUCE :

- Reduce amount that you consume & waste.
- Start compost bin for your kitchen waste
- Save energy! Turn off faucet & lights when not using.

REUSE :

- Saves money & is good for the environment
- Find new ways to reuse your old things
- Or donate them as charity

Fun Fact: Glass is 100% recyclable & can be recycled endlessly, without losing its quality!



and most importantly...

Educate, and act now!

This is very important. How is anyone going to save the world if they don't know how to? We have to educate the public and raise awareness about climate change. There are many myths; some people think that climate change is a hoax or it is a future problem, or that the CO2 level nowadays is normal because plants breathe CO2 at night. We need to educate people because many have misunderstood the reality of global warming. When people understand the importance of it, they will be willing to get involved and help protect it. We cannot leave climate change for the future generations to solve, this will only harm Earth more.

There are many earth awareness days that can catch public attention:

Earth Day : April 22

World Environment Day: June 5

International Day of Forests: March 21

World Water Day: March 22

World Oceans Day : June 8

...and many more!



The Way to a Greener World

To achieve our goal of having a greener planet to live in, we have to turn around our lifestyle a bit. Think about it... to make one burger, you need 2393 litres of water! There are some things in our life that use up more of Earth's limited resources, and we can change these habits.



- Hybrid cars are a great way to lessen extra greenhouse gas emissions. They help the environment, and there are many brands you can choose from nowadays.

- Switch your diet to plant-based foods. Livestock use up a lot of water, but this water can be used for plants, since they can grow us food and clean the air both at once.

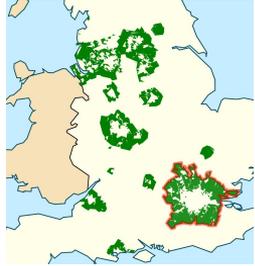


- Urban cities should use the Japanese Miyawaki urban forest method, where trees native to the area are grown in the urbs. This urban forest method assures that there is greenery even in cities.

- Switch your home energy source to renewables. Solar energy, Wind energy, hydroelectricity, and sea waves energy are all renewable ways to power your home. They have a way smaller impact on the environment than gas.



cont....



- Green belts are policies to protect some natural land around developed areas from becoming urbanized. In the UK, there are many green belts. Major cities, like in China and India, should devise similar plans to help protect their own natural lands. There are also another type of green belts, called green lines, in which the greenery/trees go through the urban area instead of circled around it.

- In countries which the land has been affected by desertification, crops suitable and able to withstand the extreme conditions should be grown. The UN is helping countries in Africa to grow appropriate crops to reduce food shortage.



- High rise forests. In Italy, there is a high rise building called Bosco Verticale. The building has trees in large containers that are built securely in a way. The idea is a great way to build greenery *and* buildings in densely populated areas, while improving air quality at and fighting climate change.

- Rooftop Gardens. Montreal, Canada, is home to the world's largest urban rooftop garden, Lufa Farms. It is a veggie farm the size of 3 football fields, and the farm sells its veggies in the grocery store under the rooftop. This is sustainability, and growing crops on a rooftop instead of cutting down trees for land is good way to get clean filtered air for humans & for earth.





Links & Resources

<https://psmag.com/news/climate-change-and-the-most-dangerous-places-in-the-world>

<https://www.thelifeyoucansave.org/blog/global-warming-and-the-need-to-give/>

<https://www.climate.gov/news-features/understanding-climate/global-warming-frequently-asked-questions#show22>

<https://climate.nasa.gov/resources/global-warming-vs-climate-change/#:~:text=Global%20warming%20is%20the%20long,gas%20levels%20in%20Earth's%20atmosphere.>

<https://www.epa.gov/ghgemissions/overview-greenhouse-gases>

<https://climate.nasa.gov/interactives/climate-time-machine#>

<https://www.epa.gov/sites/production/files/styles/medium/public/2020-04/gases-by-source-2020.jpg>

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>

<https://nymag.com/intelligencer/2017/07/climate-change-earth-too-hot-for-humans.html>

<https://www.hsph.harvard.edu/c-change/subtopics/coronavirus-and-climate-change/>



...

https://drive.google.com/file/d/1o22s-MVekIlxSb0Ldw_pcwMHDEnuUbT_/view?usp=sharing

https://ec.europa.eu/clima/policies/f-gas_en#:~:text=F%2Dgases%20are%20often%20used,their%20emissions%20are%20rising%20strongly.

<https://www.nationalgeographic.org/encyclopedia/climate-change/>

https://www.google.com/search?q=climate+change+definition&rlz=1C1GCEA_enCA748CA748&oq=climate+c&aqs=chrome.0.69i59l2j69i57j0l2j69i60l3.4317j0j1&sourceid=chrome&ie=UTF-8

<https://www.raz-kids.com/main/BookDetail/id/731>

<https://photoscissors.com/upload>

https://www.google.com/search?q=how+do+fluorinated+gases+affect+climate+change&rlz=1C1GCEA_enCA748CA748&oq=how+do+fluoriated+gaees+affect+cli&aqs=chrome.2.69i57j33l2.11061j0j1&sourceid=chrome&ie=UTF-8

<http://www.primaryhomeworkhelp.co.uk/riverthames/pollution.htm#:~:text=It%20was%20decided%20that%20'Treatment,in%20the%20Thames%20became%20cleaner>

<https://www.sfgate.com/weird/article/Indonesia-Citarum-fishing-dead-body-Jakarta-12969867.php>

<https://www.theguardian.com/global-development/2020/nov/02/rotten-river-life-on-one-of-the-worlds-most-polluted-waterways-photo-essay>



...

<https://www.iucn.org/resources/issues-briefs/ocean-warming#:~:text=The%20ocean%20absorbs%20most%20of,for%20marine%20fishes%20and%20mammals.>

<https://www.edf.org/blog/2013/10/08/5-ways-climate-change-affecting-our-oceans>

<https://www.ccacoalition.org/en/slcp/methane>

<https://insideclimatenews.org/news/11092019/nitrous-oxide-climate-pollutant-explainer-greenhouse-gas-agriculture-livestock/>

<https://sciencing.com/air-pollution-characteristics-13638130.html>

https://ec.europa.eu/jrc/sites/jrcsh/files/styles/normal-responsive/public/adobestock_269421643.jpeg?itok=9rWiz8oX

https://www.iberdrola.com/wcorp/gc/prod/en_US/comunicacion/cambio_climatico_economia_2_res/Infographic_Impact_Climate_Change.jpg

https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/13_Why-It-Matters-2020.pdf

<https://www.propublica.org/article/climate-infectious-diseases>

<https://www.conservation.org/stories/impact-of-covid-19-on-nature>

<https://www.water-pollution.org.uk/global-warming-and-water-pollution/>

<https://timesofindia.indiatimes.com/travel/destinations/norway-pledges-to-go-green-becomes-the-first-country-to-ban-deforestation/as73696460.cms#:~:text=Yes%2C%20as%20per%20a%20newly,impact%20on%20an%20international%20level.>

<https://www.downtoearth.org.in/news/pollution/bihar-bans-tree-felling-65186#:~:text=The%20Government%20of%20Bihar%20recently,tree%2Dprotection%20Act%20in%20Bihar>



...

<https://www.edf.org/blog/2013/10/08/5-ways-climate-change-affecting-our-oceans>

<https://www.space.com/planet-venus-could-have-supported-life.html>

<https://www.forbes.com/sites/startswithabang/2019/03/27/what-was-it-like-when-venus-and-mars-became-uninhabitable-planets/?sh=1a6d8fa67b91>

<https://earthyuniverse.com/was-ancient-mars-like-earth-how-mars-died-while-earth-lived/>

<https://scitechdaily.com/how-venus-and-mars-can-teach-us-about-the-past-and-future-of-earth/>

<https://www.voanews.com/silicon-valley-technology/scientists-say-young-earths-atmosphere-much-today>

<https://www.saudi24news.com/2020/11/with-a-hot-and-dense-atmosphere-the-earth-survived-the-fate-of-venus.html>

https://upload.wikimedia.org/wikipedia/commons/thumb/1/16/Earth_formation.jpg/220px-Earth_formation.jpg

<https://www.epa.gov/climate-indicators/oceans>

<http://www.acclimatise.uk.com/2019/08/26/impact-of-climate-change-on-bees-and-food-production/#:~:text=As%20global%20temperatures%20rise%2C%20North,so%20their%20range%20is%20shrinking.>

<https://www.nationalobserver.com/2020/02/07/news/bees-disappearing-due-climate-change>

<https://www.britannica.com/story/what-would-happen-if-all-the-bees-died>



...

<https://www.eesi.org/climate-change-FAQ>

<https://www.sciencedirect.com/science/article/pii/S2210909910000056>

https://www.huffpost.com/entry/hamburger-water-footprint_n_1624394

https://www.google.com/search?q=montreal+rooftop+garden&rlz=1C1GCEA_enCA748CA748&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiY7PS11vfUAhVL_J4KHTf-D4cQ_AUoAXoECAOQAw&biw=1280&bih=689#imgrc=zLLYGcSGVUSEaM&imgdii=veQaymuzoXUc6M

<https://www.theverge.com/2017/8/9/16112758/milan-vertical-forest-stefano-boeri-video>

<https://www.myclimate.org/information/faq/faq-detail/what-are-the-effects-of-climate-change/>

<https://www.wwf.org.uk/updates/10-myths-about-climate-change>

<https://www.carbonbrief.org/analysis-why-scientists-think-100-of-global-warming-is-due-to-humans>

<https://climate.nasa.gov/scientific-consensus/>

<https://earthobservatory.nasa.gov/features/GlobalWarming/page3.php>

<https://earthobservatory.nasa.gov/features/GlobalWarming/page4.php>

<http://www.eniscuola.net/en/argomento/air-pollution/improving-air-quality/montreal-and-kyoto/>

<https://www.ibtimes.sg/scientists-want-spray-aerosols-into-sky-cool-down-earth-20013>

<https://climate.nasa.gov/evidence/#:~:text=Earth's%20climate%20has%20changed%20throughout,era%20%E2%80%94%20and%20of%20human%20civilization>

<http://fossilfool.world/#yes-no-start>

<https://climateandcapitalism.com/2016/09/30/are-renewables-really-environmentally-friendly/>



...

<https://reallifeoptions.org/go-green-in-10-simple-steps/>

<https://response.restoration.noaa.gov/about/media/8-ways-keep-earth-clean.html>

<https://www.nrdc.org/stories/how-you-can-stop-global-warming>

<https://www.theguardian.com/environment/2019/jul/04/planting-billions-trees-best-tackle-climate-crisis-scientists-canopy-emissions>

<https://climate.nasa.gov/news/2927/examining-the-viability-of-planting-trees-to-help-mitigate-climate-change/>

<https://www.bloomberg.com/news/articles/2020-12-17/a-10-billion-tree-plan-is-restoring-pakistan-s-lost-forests>

<https://www.globalcitizen.org/en/content/environmentalists-planting-trees-around-the-world/>

<https://images.theconversation.com/files/341242/original/file-20200611-80770-102058m.jpg?ixlib=rb-1.1.0&q=45&auto=format&w=1200&h=1200.0&fit=crop>

<https://www.forbes.com/sites/trevornace/2019/05/29/new-filipino-law-requires-every-student-to-plant-10-trees-if-they-want-to-graduate/?sh=701ae8ac5aeb>

<https://www.investopedia.com/articles/markets-economy/090716/5-countries-produce-most-waste.asp>

<https://www.goodnet.org/articles/sweden-recycling-so-much-that-country-running-out-trash>

<https://www.veganfoodandliving.com/features/the-worlds-most-eco-friendly-cities/>

<https://www.nrdc.org/stories/air-pollution-everything-you-need-know#:~:text=%E2%80%9CBurning%20fossil%20fuels%20releases%20gases,earth's%20temperature%2C%E2%80%9D%20Walke%20says.>



...

<https://oceanservice.noaa.gov/facts/ocean-oxygen.html#:~:text=Scientists%20estimate%20that%2050%2D80,some%20bacteria%20that%20can%20photosynthesize.&text=But%20this%20little%20bacteria%20produces,oxygen%20in%20our%20entire%20biosphere.>

<https://scholarworks.bgsu.edu/cgi/viewcontent.cgi?article=1389&context=honorsprojects>

<https://helpsavenature.com/top-ten-most-polluted-rivers-of-world>

<https://www.wwf.org.au/news/blogs/plastic-waste-and-climate-change-whats-the-connection#gs.tvkm3r>

https://en.wikipedia.org/wiki/Environmental_impact_of_shipping#:~:text=The%20environmental%20impact%20of%20shipping,also%20includes%20greenhouse%20gas%20emissions.&text=There%20are%20now%20over%20100%2C000,6%2C000%20are%20large%20container%20ships.

<https://cleanair.camfil.us/2017/10/30/air-pollution-in-developing-countries/#:~:text=Air%20pollution%20in%20developing%20countries%20tends%20to%20be%20worse%20than,and%20resources%20to%20fight%20pollution.&text=Energy%20production%20is%20one%20of,developed%20countries%20comes%20from%20coal.>

<https://www.weforum.org/agenda/2018/10/what-makes-copenhagen-the-worlds-most-bike-friendly-city/#:~:text=There%20are%20675%2C000%20bicycles%20and,than%20five%2Dto%2Done.>

<https://worldpopulationreview.com/country-rankings/cleanest-countries-in-the-world>

<https://www.intechopen.com/books/water-challenges-of-an-urbanizing-world/water-pollution-effects-prevention-and-climatic-impact>



...
<https://www.showcaves.com/english/explain/Speleothem/Pillar.html>
<https://www.nps.gov/ozar/learn/education/speleothems.htm#:~:text=The%20speleothem%20with%20which%20most,a%20%22G%22%20for%20ground.>
https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSowLMSKl4cdrvq7cUoCLbkaLGlp72AE8U_Ig&usqp=CAU
<https://www.showcaves.com/english/explain/Speleothem/Pillar.html>
<https://www.ncdc.noaa.gov/news/picture-climate-how-we-can-learn-corals>
<https://www.nps.gov/ozar/learn/education/speleothems.htm>
<https://www.sciencedirect.com/topics/earth-and-planetary-sciences/speleothem>
<https://www2.usgs.gov/landresources/lcs/paleoclimate/archives.asp>
<https://www.nationalgeographic.org/encyclopedia/paleoclimatology-RL/#:~:text=Paleoclimatology%20is%20the%20study%20of%20previous%20climates%20that%20have%20existed,our%20present%20and%20future%20climate.>
<https://icecores.org/about-ice-cores>
<https://www.ncdc.noaa.gov/news/picture-climate-what-can-we-learn-ice>
<https://blogs.ei.columbia.edu/2017/04/04/how-we-know-climate-change-is-not-natural/>
<https://climate.nasa.gov/evidence/>
<https://www.verywellfamily.com/parents-guide-to-science-fair-project-terms-620830#:~:text=Application%3A%20The%20real%2Dworld%20implications,The%20conclusion%20sums%20everything%20up.>
<https://skepticalscience.com/climate-change-little-ice-age-medieval-warm-period.htm>
<https://climate.nasa.gov/evidence/>
<https://www.amnh.org/explore/ology/earth/ask-a-scientist-about-our-environment/will-earth-run-out-of-water>



Acknowledgments

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by [SlidesCarnival](#) ( Carnival)
- Photographs by [Unsplash](#)

I'd like to thank all the websites, links, & data I used to gather my research,

Also, I would like to thank my teachers who gave me this opportunity to participate,

And finally, I would like to thank my mom and dad for guiding me and giving me ideas.



*Thanks For
Watching!*