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**Is Climate Change Real?**

**Evidence, fact, and argument of climate Change from different perspective.**

Human population growth has been on the increase for the last two decades, and it is estimated 7.5 billion in the year 2017 according to United Nations estimate data. I firmly believe the rapid growth of human population will exert pressure the environment through extraction of basic needs, the vast increase of urbanization for permanent settlement, and the demand for energy with the enormous industrial growth of production and transport. The emission of the greenhouse to the atmosphere and the human activities are primary causes of climate change.

Firstly, the history of human civilization has resulted in the evolution of urbanization from temporary shelter to permanent houses which in turn created a lot of deforestation to the beautiful land escape of the environment for settlement. The growth of this urbanization demanded land to clear for settlement. As a result, a lot of trees were cut, stones quarried to build the beautiful houses we live today. Meanwhile, urbanization damaged the planet that sustains all known life; In the Journal of applied Ecology Nelson et al. argues that "Our watersheds have already lost species due to urbanization; the impact will be greater in newly urbanizing areas" (161). This research suggests that urbanization not only a threat to species on the land, but also to many aquatic species like the spawning which the research result shows how urbanization affected them. Similarly, urbanization cleared many species that lived the devastated habitant hence causing unbalanced ecosystem. Trees attract rain, produce oxygen, and most importantly produce food for many species. The process of cutting trees eliminates the chain of interdependence biosphere and even puts on the verge extinction of many species on this planet.

Secondly, this urbanization and the growth of the population created the necessity of spaces for farming to produce enough food for every single individual on the planet. This urbanization accelerated the agricultural industry that too required the area, henceforth clearing more trees. In the Journal written by Bartzen et al. notes that "Before the European settlement, large expanses of native grasslands were common, but fertile soils and accessibility made the Prairie pothole region ideal for agriculture" (256). This has created the notion of using the majority of the wetland as agricultural land hence reducing vast of the landscape. The farm industry also introduced the use of chemical substances like the pesticides and other chemical fertilizers which have done significant damage to the earth and then drained to the water bodies. On the other hand, agricultural product required transportation which also produces energy and contributing more greenhouse to the atmosphere. The industrial chemicals have also polluted the water bodies like rivers, lakes, and ocean by adding chemicals residue. This chemical residue from the industry adds more toxic to the lakes and adversely affecting the aquatic ecosystem. Similarly, the polluted water bodies affect the health condition of the communities that live the surrounding of polluted water bodies.

Thirdly, energy is another essential element of the human life, let it be electricity, wood, natural gas or heating oil. The high demand for energy for either heating our houses or cooling refrigerators will involve emission of combustion fossil fuel to the atmosphere. The process of extraction energy as oil or gas will also include severe damage, which will upshot climatically damage to the environment. The emission of the fossil fuel will increase the temperature in the world. In the article of Greenhouse Effect and Climate Change by Fenger et al. who has extensively written about the greenhouse effect admits that "An important consequence of global warming can be an increase in global (eustatic) sea level, due to thermal expansion of the oceans and melting of glaciers and the Greenland ice sheet" (379). This rise of temperature will melt the polar ice, and therefore will raise the sea level which consequently causes significant flooding to the coastal towns and villages, thus damaging human, property, and the environment at large. Without a proper intervention of the greenhouse emission, the global temperature will keep rising and will lead the world in catastrophes climatically.

Fourthly, they are other opinions that believe climate change occurs naturally, and human has no influence on it. In the book of Endangered Planet by Burnie illustrates that "A small minority of scientist believes that today's global warming is just a temporary problem that will soon correct itself" (40). Furthermore, others argue that climate change is exaggerated by scientist to scare people and generate money from the government in big research projects. In the book of Man-Made Global Warming: Unraveling a Dogma by Labohm et al. insists that "They want to keep their job and their jobs depend upon the continuity of funding. Several scientists have observed that it is easier to attract money when the research supports an alarming view" (1). This author argues that the climate science is politically exaggerated by the scientist to make money. There is a lot of emotions involved in the climate research, and that is partly connected with the enormous amounts of subsidies (2). The author claims greenhouse effect is a hypothesis but not a fact. Nevertheless, the majority of the scientist strongly agree that the climate change is real and its causes are mainly to blame human.

Finally, the considerable growth of human population regarding the steady industrial revolution that aid humanity in the production and transport industries will exacerbate the debilitating climate condition of the world. The emission of the enormous carbon dioxide and other greenhouse gases to the atmosphere by the developed nations will put the risk in the lives of the most vulnerable countries of the world. The glaciation and the general global warming is a threat to the native people who live in the Arctic. On the other hand, the people who live in the hot environment will be adversely affected by the global warming as they will not be able to produce food and their land will turn to desert. Climate change is a world problem and the world must hold hands to agree on workable solutions to the aggravating climatic conditions before it is too late.

**The nine-alarming questions of climate change**

* <https://www.vox.com/science-and-health/2017/6/1/15724164/9-questions-climate-change-too-embarrassed-to-ask>

### In 2018, the United Nations’ [**Intergovernmental Panel on Climate Change**](https://www.vox.com/2018/10/8/17948832/climate-change-global-warming-un-ipcc-report) found that it is possible to limit global warming to 1.5 degrees Celsius this century, but the world may have as little as 12 years left to act. The US government’s [**National Climate Assessment**](https://www.vox.com/2018/11/24/18109883/climate-report-2018-national-assessment), with input from NASA, the Environmental Protection Agency, and the Pentagon, also reported that the consequences of climate change are already here, ranging from nuisance flooding to the spread of mosquito-borne viruses into what were once colder climates.

### **1) What is global warming?**

In short: The world is getting hotter, and humans are responsible.

Yes, the planet’s temperature has changed before, but it’s the rise in average temperature of the Earth's climate system since the late 19th century, the dawn of the Industrial Revolution, that’s important here.

Temperatures over land and ocean [**have gone up**](https://climate.nasa.gov/vital-signs/global-temperature/) 0.8° to 1° Celsius (1.4° to 1.8° Fahrenheit), on average, in that span:

### Greenhouse gases like carbon dioxide [**trap heat**](http://climate.nasa.gov/causes) at the Earth’s surface, preventing that heat from escaping back out into space too quickly. When we burn coal, natural gas, or oil for energy, or when we cut down forests that usually soak up greenhouse gases, we [**add even more**](http://www.fas.org/sgp/crs/misc/RL34059.pdf) carbon dioxide to the atmosphere, so the planet warms up. Many experts consider 2°C of warming to be [**unacceptably high**](http://www.vox.com/cards/global-warming/why-dangerous-2-degrees-global-warming), increasing the risk of deadly heat waves, droughts, flooding, and extinctions. Rising temperatures will drive up global sea levels as the world’s glaciers and ice sheets melt. Further global warming [**could affect**](http://www.vox.com/cards/global-warming/what-impacts-will-global-warming-have-in-the-future) everything from our ability to grow food to the spread of disease

### **2) How do we know global warming is real?**

The simplest way is through temperature measurements. Agencies in the United States, Europe, and Japan have [**independently**](http://www.cru.uea.ac.uk/cru/data/temperature/) [**analyzed**](http://www.ncdc.noaa.gov/sotc/) [**historical**](https://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/ann_wld.html) temperature data and reached the same conclusion: The Earth’s average surface temperature has risen roughly 0.8° Celsius (1.4° Fahrenheit) since the early 20th century.

But that’s not the only clue. Scientists have also noted that glaciers and ice sheets around the world are melting. Satellite observations since the 1970s have shown warming in the lower atmosphere. There’s more heat in the ocean, causing water to expand and sea levels to rise. Plants are [**flowering earlier**](https://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/ann_wld.html) in many parts of the world. There’s more humidity in the atmosphere. [**Here’s**](http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/2009/bams-sotc-2009-chapter2-global-climate-lo-rez.pdf) a summary from the National Oceanic and Atmospheric Administration (see the PowerPoint)

### These are all signs that the Earth really is getting warmer and that it’s not just a glitch in the thermometers. That explains why climate scientists [**say things like**](https://www.ipcc.ch/news_and_events/docs/ar5/press_release_ar5_wgi_en.pdf), “Warming in the climate system is unequivocal.” They’re really confident about this one.

### **3) How do we know humans are causing global warming?**

Climate scientists say they are more than [**95 percent certain**](http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf)that human influence has been the dominant cause of global warming since 1950. They’re about [**as sure of this**](http://bigstory.ap.org/article/what-95-certainty-warming-means-scientists) as they are that cigarette smoke causes cancer.

Why are they so confident? In part because they have a good grasp of how greenhouse gases can warm the planet, in part because the theory fits the available evidence, and in part because alternate theories have been ruled out. Let's break it down in six steps:

1) Scientists have long known that [**greenhouse gases**](http://climate.nasa.gov/causes) in the atmosphere such as carbon dioxide, methane, or water vapor — absorb certain frequencies of infrared radiation and [**scatter them back**](http://www.ucsusa.org/global_warming/science_and_impacts/science/CO2-and-global-warming-faq.html) toward the Earth. These gases essentially prevent heat from escaping too quickly back into space, trapping that radiation at the surface and keeping the planet warm.

2) Climate scientists also know that concentrations of greenhouse gases in the atmosphere [**have grown significantly**](http://www.esrl.noaa.gov/gmd/ccgg/trends/) since the Industrial Revolution. Carbon dioxide has risen [**45 percent**](https://www.reuters.com/article/us-climatechange-greenhouse/carbon-dioxide-levels-grew-at-record-pace-in-2016-u-n-says-idUSKBN1CZ0YB). Methane has risen more than [**200 percent**](https://www.epa.gov/climate-indicators/climate-change-indicators-atmospheric-concentrations-greenhouse-gases). Through some relatively straightforward [**chemistry**](http://www.esrl.noaa.gov/gmd/icdc7/proceedings/abstracts/keeling.rFF328Oral.pdf) and [**physics**](https://www.esrl.noaa.gov/gmd/outreach/isotopes/mixing.html), scientists can trace these increases to human activities like burning oil, gas, and coal.

### 3) So, it stands to reason that more greenhouse gases would lead to more heat. And indeed, satellite measurements have shown that less infrared radiation is [**escaping out**](https://go.redirectingat.com/?id=66960X1516588&xs=1&url=http%3A%2F%2Fwww.nature.com%2Fnature%2Fjournal%2Fv410%2Fn6826%2Fabs%2F410355a0.html) into space over time and instead [**returning**](http://onlinelibrary.wiley.com/doi/10.1029/2009JD011800/abstract) to the Earth’s surface. That’s strong evidence that the greenhouse effect is increasing.

### **4) How has global warming affected the world so far?**

Here’s a list of ongoing changes that climate scientists have concluded are likely linked to global warming, as detailed by the IPCC [**here**](https://www.ipcc.ch/report/ar5/wg1/) and [**here**](https://www.ipcc.ch/working-group/wg2/).

**Higher temperatures:** Every continent has warmed substantially since the 1950s. There are [**more hot days**](https://www.nytimes.com/interactive/2017/07/28/climate/more-frequent-extreme-summer-heat.html) and fewer cold days, on average, and the hot days are hotter.

**Heavier storms and floods:** The world’s atmosphere can hold more moisture as it warms. As a result, the overall number of heavier storms has [**increased**](https://www.vox.com/energy-and-environment/2017/9/28/16362522/hurricane-maria-2017-irma-harvey-rain-flooding-climate-change) since the mid-20th century, particularly in North America and Europe (though there’s plenty of regional variation). Scientists reported in December that at least [**18 percent**](http://onlinelibrary.wiley.com/doi/10.1002/2017GL075888/full) of Hurricane Harvey’s record-setting rainfall over Houston in August was due to climate change.

**Heat waves:** Heat waves have become [**longer and more frequent**](http://www.climatechange2013.org/images/report/WG1AR5_Chapter02_FINAL.pdf) around the world over the past 50 years, particularly in Europe, Asia, and Australia.

**Shrinking sea ice:** The extent of sea ice in the Arctic, always at its maximum in winter, has shrunk since 1979, by [**3.3 percent**](http://nsidc.org/arcticseaicenews/) per decade. Summer sea ice has dwindled even more rapidly, by [**13.2 percent**](https://climate.nasa.gov/vital-signs/arctic-sea-ice/) per decade. Antarctica has seen recent years with [**record growth**](https://www.nasa.gov/content/goddard/antarctic-sea-ice-reaches-new-record-maximum) in sea ice, but it’s a very different environment than the Arctic, and the losses in the north far exceed any gains at the South Pole, so total global sea ice is on the decline.

**Shrinking glaciers and ice sheets:** Glaciers around the world have, on average, been losing ice since the 1970s. In some areas, that [**is reducing**](http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf) the amount of available freshwater. The ice sheet on Greenland, which would raise global sea levels by 25 feet if it all melted, is declining, with some sections experiencing a [**sudden surge**](https://www.vox.com/energy-and-environment/2017/12/14/16772722/greenland-ice-sheet-melting-sea-level-rise) in the melt rate. The Antarctic ice sheet is also getting smaller, but at a much [**slower rate**](https://nsidc.org/cryosphere/quickfacts/icesheets.html).

**Sea level rise:** Global sea levels rose 9.8 inches (25 centimeters) in the 19th and 20th centuries, after 2,000 years [**of relatively little change**](http://www.climatechange2013.org/images/report/WG1AR5_Chapter13_FINAL.pdf), and the pace is [**speeding up**](https://sealevel.nasa.gov/news/108/new-study-finds-sea-level-rise-accelerating). Sea level rise is caused by both the thermal expansion of the oceans — as water warms up, it expands — and the melting of glaciers and ice sheets (but not sea ice).

**Food supply:** A hotter climate can be both good for crops (it lengthens the growing season, and more carbon dioxide can increase photosynthesis) and bad for crops (excess heat can damage plants). The IPCC [**found**](http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap7_FGDall.pdf) that global warming was currently benefiting crops in some high-latitude areas but that negative effects are becoming increasingly common worldwide. In areas like California, crop yields are estimated to decline [**40 percent**](http://www.mdpi.com/2073-4395/8/3/25/htm) by 2050.

**Shifting species:** Many land and marine species [**have had to shift**](http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf) their geographic ranges in response to warmer temperatures. So far, several extinctions [**have been linked**](http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap4_FGDall.pdf) to global warming, such as certain frog species in Central America.

### **Warmer winters:**In general, [**winters are warming faster than summers**](https://www.vox.com/science-and-health/2018/12/20/18136006/climate-change-warmer-winters). Average low temperatures are rising all over the world. In some cases, these temperatures are climbing above the freezing point of water. We’re already seeing massive declines in snow accumulation in the United States, which can paradoxically increase flood, drought, and wildfire risk — as water that would ordinarily dispatch slowly over the course of a season instead flows through a region all at once. **5) What impacts will global warming have in the future?**

It depends on how much the planet actually heats up. The changes associated with 4° Celsius (or 7.2° Fahrenheit) of warming are expected to be more dramatic than the changes associated with 2°C of warming.

Here’s a basic rundown of big impacts we can expect if global warming continues, via the IPCC ([**here**](https://www.ipcc.ch/report/ar5/wg1/) and [**here**](https://www.ipcc.ch/working-group/wg2/)).

**Hotter temperatures:** If emissions keep rising unchecked, then global average surface temperatures will be at least 2°C higher (3.6°F) than preindustrial levels by 2100 — and possibly 3°C or 4°C or more.

**Higher sea level rise:** The expert consensus is that global sea levels will rise somewhere between [**0.2 and 2 meters**](https://sealevel.nasa.gov/understanding-sea-level/projections/empirical-projections) by the end of the century if global warming continues unchecked (that’s between 0.6 and 6.6 feet). That’s a wide range, reflecting some of the uncertainties scientists have in how ice will melt. In specific regions like the Eastern United States, sea level rise could be even higher, and around the world, the rate of rise is [**accelerating**](https://sealevel.nasa.gov/news/108/new-study-finds-sea-level-rise-accelerating).

**Heat waves:** A hotter planet will mean more frequent and severe [**heat waves**](https://www.epa.gov/heat-islands/climate-change-and-heat-islands).

**Droughts and floods:** Across the globe, wet seasons are expected to become wetter, and dry seasons drier. As the IPCC [**puts it**](http://www.climatechange2013.org/images/report/WG1AR5_Chapter12_FINAL.pdf), the world will see “more intense downpours, leading to more floods, yet longer dry periods between rain events, leading to more drought.”

**Hurricanes:** It’s not yet clear what impact global warming will have on tropical cyclones. The IPCC [**said**](http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter14.pdf) it was likely that tropical cyclones would get stronger as the oceans heat up, with faster winds and heavier rainfall. But the overall number of hurricanes in many regions was likely to “either decrease or remain essentially unchanged.”

**Heavier storm surges:** Higher sea levels will [**increase the risk of storm surges**](http://www.washingtonpost.com/blogs/wonkblog/wp/2012/10/29/yes-hurricane-sandy-is-a-good-reason-to-worry-about-climate-change/) and flooding when storms do hit.

**Agriculture:** In many parts of the world, the mix of increased heat and drought is expected to make food production more difficult. The IPCC [**concluded**](https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap7_FINAL.pdf) that global warming of 1°C or more could start hurting crop yields for wheat, corn, and rice by the 2030s, especially in the tropics. (This wouldn’t be uniform, however; some crops may benefit from mild warming, such as winter wheat in the United States.)

**6) What happens if the world heats up more drastically — say, 4°C?**

The risks of climate change would rise considerably if temperatures rose 4° Celsius (7.2° Fahrenheit) above preindustrial levels — something that’s possible if greenhouse gas emissions keep rising at their current rate.

The IPCC [**says**](https://www.ipcc.ch/site/assets/uploads/2018/02/ar5_wgII_spm_en.pdf) 4°C of global warming could lead to “substantial species extinctions,” “large risks to global and regional food security,” and the risk of irreversibly destabilizing Greenland’s massive ice sheet.

One huge concern is food production: A [**growing**](https://go.redirectingat.com/?id=66960X1516588&xs=1&url=http%3A%2F%2Fwww.nature.com%2Fnclimate%2Fjournal%2Fv2%2Fn3%2Ffull%2Fnclimate1356.html) [**number**](http://www.ocf.berkeley.edu/~marshall/papers/Hertel_etal_GEC_2010.pdf) of [**studies**](http://iopscience.iop.org/1748-9326/5/1/014010)suggest it would become significantly more difficult for the world to grow food with 3°C or 4°C of global warming. Countries like Bangladesh, Egypt, Vietnam, and parts of Africa could see large tracts of farmland turn unusable due to rising seas. Scientists are also concerned about crops [**getting less nutritious**](https://www.politico.com/agenda/story/2017/09/13/food-nutrients-carbon-dioxide-000511) due to rising CO2.

Humans could struggle to adapt to these conditions. Many people might think the impacts of 4°C of warming will simply be twice as bad as those of 2°C. But as a 2013 [**World Bank**](http://www.worldbank.org/en/topic/climatechange/publication/turn-down-the-heat-climate-extremes-regional-impacts-resilience) report argued, that’s not necessarily true. Impacts may interact with each other in unpredictable ways. Current agriculture models, for instance, don’t have a good sense of what will happen to crops if increased heat waves, droughts, new pests and diseases, and other changes all start to combine.

“Given that uncertainty remains about the full nature and scale of impacts,” the World Bank report said, “there is also no certainty that adaptation to a 4°C world is possible.” Its conclusion was blunt: “The projected 4°C warming simply must not be allowed to occur.”

**7) What do climate models say about the warming that could actually happen in the coming decades?**

That depends on your faith in humanity.

Climate models depend on not only complicated physics but the intricacies of human behavior over the entire planet.

Generally, the more greenhouse gases humanity pumps into the atmosphere, the warmer it will get. But scientists aren’t certain how sensitive the global climate system is to increases in greenhouse gases. And just how much we might emit over the coming decades remains an open question, depending on advances in technology and international efforts to cut emissions.

The IPCC groups these scenarios into four categories of atmospheric greenhouse gas concentrations known as [**Representative Concentration Pathways**](http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html). They serve as standard benchmarks for evaluating climate models, but they also have some assumptions [**baked in**](https://www.sei-international.org/mediamanager/documents/A-guide-to-RCPs.pdf).

RCP 2.6, also called RCP 3PD, is the scenario with very low greenhouse gas concentrations in the atmosphere. It bets on declining oil use, a population of 9 billion by 2100, increasing energy efficiency, and emissions holding steady until 2020, at which point they’ll decline and even go negative by 2100. This is, to put it mildly, very optimistic.

The next tier up is RCP 4.5, which still banks on ambitious reductions in emissions but anticipates an inflection point in the emissions rate around 2040. RCP 6 expects emissions to increase 75 percent above today’s levels before peaking and declining around 2060 as the world continues to rely heavily on fossil fuels.

The highest tier, RCP 8.5, is the pessimistic business-as-usual scenario, anticipating no policy changes nor any technological advances. It expects a global population of 12 billion and triple the rate of carbon dioxide emissions compared to today by 2100.

Here’s how greenhouse gas emissions under each scenario stack up next to each other:

**8) How do we stop global warming?**

The world’s nations would [**need to cut**](http://www.vox.com/2014/4/13/5610356/un-panel-heres-how-we-cut-emissions-and-avoid-a-climate-disaster) their greenhouse gas emissions by a lot. And even that wouldn’t stop all global warming.

For example, let’s say we wanted to limit global warming to below 2°C. To do that, the IPCC [**has calculated**](http://www.vox.com/2014/11/2/7146215/ipcc-climate-change-synthesis-report-phasing-out-fossil-fuels) that annual greenhouse gas emissions would need to drop at least 40 to 70 percent by mid century.

Emissions would then have to keep falling until humans were hardly emitting any extra greenhouse gases by the end of the century. We’d also have to remove [**carbon dioxide from the atmosphere**](https://www.vox.com/energy-and-environment/2017/8/18/16166014/negative-emissions).

Cutting emissions that sharply is a daunting task. Right now, the world gets [**87 percent**](http://www.vox.com/2014/6/19/5821250/these-5-charts-show-why-the-world-is-still-failing-on-climate-change) of its primary energy from fossil fuels: oil, gas, and coal. By contrast, just 13 percent of the world’s primary energy is “low carbon”: a little bit of wind and solar power, some nuclear power plants, a bunch of hydroelectric dams. That’s one reason global emissions keep rising each year.

To stay below 2°C, that would all need to change radically. By 2050, the IPCC notes, the world would need to triple or even quadruple the share of clean energy it uses — and keep scaling it up thereafter. Second, we’d have to get dramatically more efficient at using energy in our homes, buildings, and cars. And stop cutting down forests. And reduce emissions from agriculture and from industrial processes like cement manufacturing.

The IPCC also notes that this task becomes even more difficult the longer we put it off, because carbon dioxide and other greenhouse gases will keep piling up in the atmosphere in the meantime, and the cuts necessary to stay below the 2°C limit become more severe.

**9) What are we actually doing to fight climate change?**

A global problem requires global action, but with climate change, there is a yawning gap between ambition and action.

The main international effort is the 2015 Paris climate accord, of which the United States is the only country in the world that [**wants out**](https://www.vox.com/energy-and-environment/2017/11/7/16617612/united-states-paris-climate-accords). The deal was hammered out over weeks of tense negotiations and weighs in at [**31 pages**](https://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf). What it does is actually pretty simple.

The backbone is the global target of keeping global average temperatures from [**rising 2°C**](https://www.vox.com/2014/4/22/5551004/two-degrees)(compared to temperatures before the Industrial Revolution) by the end of the century. Beyond 2 degrees, we risk dramatically higher seas, changes in weather patterns, food and water crises, and an overall more hostile world.

Critics have argued that the 2-degree mark is arbitrary, [**or even too low**](https://www.vox.com/2014/4/22/5551004/two-degrees), to make a difference. But it’s a starting point, a goal that, before Paris, the world was on track to wildly miss.

**How this project helps as a future elementary teacher**

1. Environmental education is a key component in Saskatchewan curriculum and go through the research of this project I learned a lot knowledge of various nature in climate change.
2. I also now know both the current and past future of our environment including all the stakeholder involving the fight of climate change.
3. My perspective has changed based on the beliefs of climate change, and I now know if the world does not agree on the solution of climate change the problem will worse than it is today. I want to do individual effort to safe the environment to my capacity based on how I manage the waste in my home.
4. It was a mazing to learn the Indigenous way of solving the climate change. <https://www.indigenousclimateaction.com/>
5. It is very surprising to learn some written literature refute the existence of climate change.

**The questions I have till know**

1. Why people believe the medical facts of the scientist, but not the climate change evidence?
2. Who is to blame climate change?
3. What will happen if the necessary action of climate change is not taken?
4. Is the carbon reduction policy of Canada enough to solve climate change?
5. How will the world handle the climate change refugees, like those affected the calamities of floods and other effects of climate change?

**Handout given to students**

**The scientific evidence of climate change**

1. **Global temperature rise (**<https://climate.nasa.gov/evidence/>)

* The planet's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since the late 19th century, a change driven largely by increased carbon dioxide and other human-made emissions into the atmosphere.
* Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010.
* Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year from January through September, with the exception of June — were the warmest on record for those respective months

1. **Warming Oceans**

* The oceans have absorbed much of this increased heat, with the top 700 meters (about 2,300 feet) of ocean showing warming of more than 0.4 degrees Fahrenheit since 1969.

1. **Shrinking ice Sheets**

* The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 286 billion tons of ice per year between 1993 and 2016, while Antarctica lost about 127 billion tons of ice per year during the same time period.
* The rate of Antarctica ice mass loss has tripled in the last decade.[7](https://climate.nasa.gov/evidence/#footnote_7)

1. **Glacial retreat**

Glaciers are retreating almost everywhere around the world — including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa

1. **Decrease snow cover**

* Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier.

1. **Sea level rise**

* Global sea level rose about 8 inches in the last century. The rate in the last two decades, however, is nearly double that of the last century and is accelerating slightly every year**.**

1. **Declining arctic sea ice**

* Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades
* An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

**8. Ocean acidification**

* Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent.
* This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans.
* The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year.

Teacher/student resources

* <https://climate.nasa.gov/resources/education/>
* <https://climatekids.nasa.gov/>
* Canada's climate has been warming at roughly twice the rate of the rest of the world. In Northern Canada, it's even higher.
* <https://www.cbc.ca/news/opinion/climate-change-report-1.5079886>
* Climate change rooted in indigenous teaching.
* <https://www.cbc.ca/news/canada/saskatchewan/michelle-brass-climate-change-future-40-1.4954839?fbclid=IwAR12aqB--qT06L4gplmH8Sd0vr5yCxsJuhrwbR0yLcYAfFq6RtazeAoGqA0>
* <https://www.vox.com/science-and-health/2017/6/1/15724164/9-questions-climate-change-too-embarrassed-to-ask>

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