

The Science of Climate Change--Summary

Earth's atmosphere is composed of over a dozen elements and compounds and functions to maintain an environment that makes life possible.

Atmosphere regulates temperature, oxygen, water distribution, and much more. In addition to being a central component in respiration and photosynthesis, a required compound for all living organisms, CO₂, is an atmospheric gas that plays a central role in temperature regulation of our planet's atmosphere. CO₂ has the physical property of blocking heat transmission, or "trapping" heat. As a result the CO₂ level in our atmosphere (along with a few other key "greenhouse" gasses) traps just the right amount of infrared radiation (heat) from the sun to keep our planet in a livable range. (Some of this heat is reflected back to space and other is absorbed by oceans and land.) This operates much like a greenhouse, hence referred to as the "greenhouse effect." This process has been ongoing for billions of years. So in addition to being essential for photosynthesis and the process of living organisms, CO₂ creates the greenhouse effect which is essential to maintain a livable habitat (environment/atmosphere) for all of life on earth.

Today, in the year 2019, CO₂ levels in our atmosphere are 410 ppm (parts per million) and rising. Extensive long term studies of ice core samples, dendrochronology (tree rings), and various other data sources confirm that over the past 800,000 years the level of CO₂ has never risen above 280 ppm.

Why are current levels of CO₂ so much higher than historic levels? The current rise to 410 ppm began recently with the advent of the industrial revolution (large scale burning of fossil fuels that release CO₂) and mass deforestation (global forests have decreased by 50% over the past several hundred years.) Forests act as a "sink" for carbon dioxide, removing it from the air. Consequently, modern civilization has been contributing to CO₂ rise on two fronts--pumping vast amounts of CO₂ and other greenhouse gasses into the atmosphere while simultaneously reducing the planet's ability to remove CO₂.

The fact that the carbon increase correlates historically to the large scale burning of fossil fuels is not the only indicator that human activity is responsible for the CO₂ increase. Analysis of the molecular structure of the carbon in today's atmosphere provides more concrete evidence. Ancient carbon (from oil and coal formed millions of years ago) has a slightly different molecular structure than carbon in our current carbon cycle. Analysis shows that a significant amount of the current carbon in our atmosphere is ancient carbon, confirming the burning of fossil fuels to be responsible for a major component of the CO₂ increase.

So where does temperature come in? The 800,000 year history studies have also revealed an important correlation between CO₂ concentrations and global temperature. Placed side by side, graphs of global temperature and CO₂ reveal a near perfect correlation--high CO₂ correlates to high temperature, low CO₂ correlates to lower temperature consistently over the 800,000 year period. This temperature/CO₂ correlation is manifest in our current era. Along with our spiking CO₂ levels, over the past century our planet has undergone substantive global average *temperature increase* ("global warming") of about 0.7 degrees centigrade. (Note: For perspective, the global average temperature difference between today and the ice age is about 5 degrees centigrade). Additionally, this temperature increase has occurred more rapidly than any increase in the 800,000 year history.

The increased global average temperature (referred to as "global warming") has altered the behavior of weather events in type and intensity--hurricanes, droughts, floods, and more. As these more extreme events have persisted, they alter the broader climate profiles of regions. (Note: "weather" refers to specific atmosphere events, while "climate" is the average and consistent pattern of weather events over time). Thus, "global warming" is the driver of what we are currently experiencing in the form of "climate change" around the world. Increased CO₂ from fossil fuel use, industrial agriculture and other industrial activities that increase greenhouse gas emissions, combined with deforestation, will only accelerate and worsen this trend to potentially catastrophic levels by mid century.

Solutions to the climate change problem currently exist and are operational. The practices and technologies for climate solutions are actually drivers of

economic growth, contrary to much propaganda one gets from media, certain politicians, oil companies, etc. Consequently, the solution to the climate change problem lies in human will, not in the lack of knowledge or technical capacity.

Solutions:

1. Reduce/eliminate the use of fossil fuels.
2. Reduce and reverse the trend of deforestation.
3. Change and redesign any practices that cause other greenhouse gasses (methane in particular) to be emitted (e.g. industrial meat production).

Drawdown is an organization that has mathematically calculated how to reduce greenhouse gas emissions to zero by 2050 through the scaling of 100 practices and technologies. 80 of these technologies/practices are currently operational and being implemented around the world.

Visit: www.drawdown.org

Addendum:

Another large problem created by the increase of CO₂ is the increase in absorption by the oceans (oceans, along with forests, are sinks for carbon) This in turn has lowered the Ph (increased acidity) of the oceans by about 35%, a critical factor in how shellfish can create calcium carbonate for their shells (coral reefs and many shellfish, key players in the interdependent ocean ecosystem are threatened as result).

Information sources for this summary:

This summary is not a "scientific paper" or study. It is a summary of scientific findings, written by a teacher who has been teaching for nearly 30 years, following, studying and teaching the scientific developments in this area. It *summarizes* key elements of the results of focused scientific studies from over 5 decades, with some dating back over a hundred years. Today, 98% of all publishing reputable scientists from 200 nations and 100% of all scientific academies worldwide are in consensus on the summary stated above.

Specific sources for this summary include but are not limited to the following:

<https://climate.nasa.gov/>

https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

<https://scottbeall.com/2018/wp-content/uploads/2018/09/CaseforYoungPeople31.pdf>

<http://dels.nas.edu/resources/static-assets/exec-office-other/climate-change-full.pdf>