

Article 2 Global Warming Science Certain

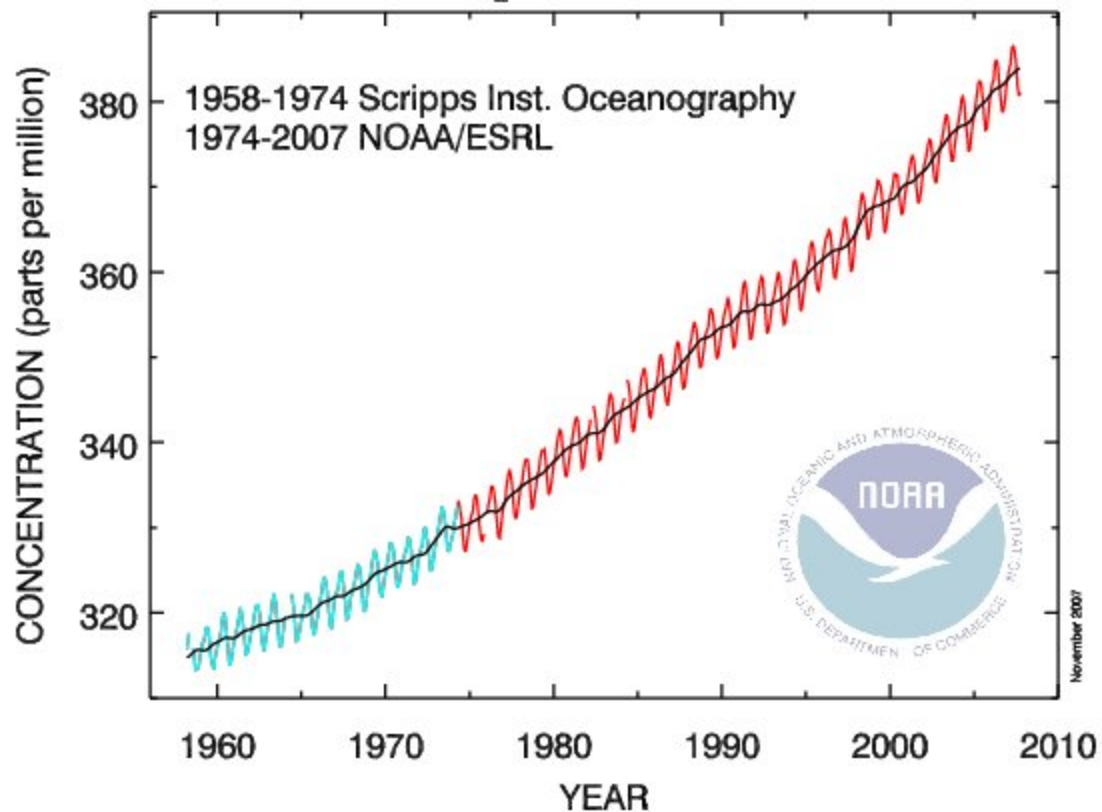
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Climate change, sometimes called global warming, is the gradual warming of the planet caused by man's activities. The Earth's climate has always been changing, sometimes getting a little hotter, sometimes cooler, but the impact of 6.6 billion industrious human beings is now far outpacing naturally occurring climate cycles. This second article on global warming explains the mechanisms causing climate change.

The principal human activity causing climate change is burning coal and oil, called fossil fuels. As long as coal and oil remain underground they don't affect the climate, but when burned, they release carbon dioxide (CO₂), an odorless, colorless, non-toxic gas. And they release a lot of it. Burning one gallon of gasoline releases 24 pounds of CO₂ into the atmosphere. Burning one pound of coal releases two pounds of CO₂ into the atmosphere. And like pouring water into a glass, pouring CO₂ into the atmosphere causes it to fill up with more and more CO₂.

For the last 400,000 years the concentration of CO₂ in the Earth's atmosphere varied naturally between 200 and 300 PPMV (parts per million by volume). Atmospheric CO₂ concentrations started increasing steadily around 200 years ago when we began mining coal and later using oil. As the Earth's population grew, became more industrialized and rapidly consumed coal and oil, CO₂ concentrations in the atmosphere increased to unprecedented levels. Carbon dioxide levels are now 27 percent higher than at any point in the last 650,000 years.

Atmospheric CO₂ at Mauna Loa Observatory



What we have only recently realized is that the increasing atmospheric concentration of CO₂ is directly causing the Earth to warm and our planet's climate to change. Even this seemingly small increase in CO₂ is having a profound greenhouse warming effect on climate. As the Sun warms the Earth, some heat is absorbed and some is reflected back towards outer space. CO₂ in the atmosphere traps reflected heat, and the higher the concentration of CO₂ in the atmosphere, the more heat gets trapped.

The Earth has a delicate heat balance. The Earth's oceans, rivers and valleys formed over tens of thousands of years, much as a result of our stable climate. The places where food grows well are a result of our climate. The places where lakes form to store water are a result of our climate. While natural climate changes occur over 10,000 years and give the planet time to make new rivers and allow fertile areas to gradually shift across the globe, man-made climate change occurs 100 to 1000 times more rapidly. Dr. Peter B. deMenocal, of the Lamont-Doherty Earth Observatory at Columbia University, said "It's

not this abstract notion that happens over millions of years. The magnitude of what we're talking about greatly, greatly exceeds anything we've withstood in human history.”

Some fertile areas will suffer drought and quickly become unproductive. The Intergovernmental Panel on Climate Change (IPCC) estimates 232,000 square miles of cultivatable farm land in Africa alone will be ruined by inevitable climate change already in progress as a result of the current atmospheric CO₂.

What can we expect on Kauai? Both the US Environmental Protection Agency (EPA) and the IPCC predict, “Warming and other climate changes may expand the habitat and infectivity of disease-carrying insects [into Hawaii], increasing the potential for transmission of diseases such as malaria and dengue (break bone) fever.” Certainly Kauai can expect a big impact from rising sea level. Every refinement of research brings more accurate predications of the coming global sea level rise. IPCC research confirms *the CO₂ already in the atmosphere commits us to a minimum 4.6 foot sea level rise.* With development and infrastructure in Kauai located predominately in low costal areas we will be especially impacted. The sea level rise which scientists now consider inevitable within our lifetimes will put Nawiliwili and Port Allen harbors underwater along with many stretches of costal road. The fight now is to reduce global warming so we limit climate change to prevent the 20 foot to 40 foot sea level rise that will happen without quick global action to reduce CO₂ emissions. James E. Hansen, who directs NASA's Goddard Institute of Space Studies, underscored the urgency in an interview with the Washington Post, “It's not something you can adapt to. We can't let it go on another 10 years like this. We've got to do something.” He explained that the changes we will experience if we don't take quick action “imply changes that constitute practically a different planet.”

Beyond global warming from atmospheric CO₂, climate scientists are very concerned about climate tipping points. These tipping points occur when the Earth warms enough to jump start natural processes that cause increasing, runaway warming. “When you start

messing around with these natural systems, you can end up in situations where it's unstoppable. There are no brakes you can apply," said Dr. David Viner, a senior scientist at the Climatic Research Unit at the University of East Anglia in the UK. Scientists are especially concerned about three tipping points, deep ocean gas hydrates, melting glaciers, and changing ocean currents.

Dr. Gerald Dickens of Rice University notes that the cold, deep ocean contains more than 10 times as much carbon as the atmosphere, trapped in frozen gas hydrates. These gas hydrates are sensitive to relatively small changes in deep-ocean temperature. Scientists believe four times in the distant past, 250, 183, 120, and 55 million years ago gradual warming of the planet caused the ocean to warm enough to release these gas hydrates into the atmosphere resulting in abrupt, runaway climate change.

Glaciers, especially in Greenland and Antarctica, represent a stabilizing influence on the climate, much like ice cubes keep a drink cold. Glaciers typically move very slowly towards the sea, their total size remaining approximately constant because as they drop huge ice bergs into the sea, snow fills in gradually becoming hard packed ice. But scientists have recently recorded glaciers accelerating their move to the sea. Researchers Dr. Pannir Kanagaratnam, at the University of Kansas NSF Center for Remote Sensing of Ice Sheets, and Dr. Eric Rignot of NASA's Jet Propulsion Laboratory in Pasadena, California report Greenland's 21 largest glaciers accelerated 28 percent between 1996 and 2000 and 57 percent between 1996 and 2005. They report the flow acceleration is widespread and systematic. Dr. Duncan Wingham, Professor of Climate Physics at University College London, tracks Antarctic ice and reports its loss has picked up speed in recent years. As ice trapped in glaciers decreases on a global scale, scientists fear even more warming might occur. Scientists at the U.S. Geological Survey estimate that if all the ice sitting on land in Greenland and Antarctica melted it would cause global sea levels to rise by 215 feet, but no climate change models currently predict such a catastrophe.

The effect of global warming on ocean currents is a third potential runaway climate change. Ocean and climate models developed by Dr. Uwe Mikolajewicz, at the Max Planck Institute for Meteorology, in Hamburg Germany predict even moderate global warming could cause ocean effects that might lead to runaway warming. His model predicts warmer surface water at high latitudes will reduce the upwelling of dense, salty water from the deep ocean. This, in turn, reduces the total amount of CO₂ the ocean can hold resulting in even higher greenhouse gas concentrations in the atmosphere. The last 20 years of North Atlantic Ocean temperature measurements match the results predicted by these models.

Global warming and serious, inevitable consequences are an established fact. There is still time to avoid tragic consequences if we all act immediately. “If there’s no action before 2012, that’s too late,” said Rajendra Pachauri, the scientist who heads the IPCC. “What we do in the next two to three years will determine our future. This is the defining moment.”

The third article in this series appearing next month will outline the scope of global solutions needed to combat climate change.

Sidebar: Why Trash and Meat Matter

CO₂ isn’t the only greenhouse gas. Methane (CH₄) is a greenhouse gas, pound for pound 20 times more powerful than CO₂. Methane is the sour smell we associate with decomposing waste. Small landfills, like Kauai’s, which don’t trap methane released by decomposing organic garbage, are a major source of methane. Kauai’s Kekaha landfill releases methane causing global warming equivalent to 250 million vehicle miles annually, making it one of Kauai’s largest contributions to climate change.

Anyone with a normal sense of smell who has lived near a farm or industrial feedlot knows animal wastes are a significant source of methane. Manure also releases nitrous oxide (N₂O), a greenhouse gas 296 times more potent than CO₂. Global consumption of meat is increasing rapidly, worsening climate change. In 1962 the world’s 3.1 billion

people consumed 48 pounds of meat per person, a total of 68 million metric tons. In 2002 the Earth's 6.2 billion people consumed 88 pounds per person, or 247 million metric tons of meat, 3.6 times more than in 1962. The UN Food and Agriculture Organization (FAO) reports *the global livestock sector generates 18 percent more greenhouse gas emissions than the entire global transportation sector*, including cars, trucks, and airplanes.

One immediate thing you can do to combat global warming is to be sure organic waste like food waste and green waste don't get in trash heading to the Kekaha landfill. The second thing we can all do is eat less meat. While giving up meat, dairy, and eggs would reduce 50 percent more greenhouse gas than trading your SUV for a hybrid car, most of us are not ready to go completely vegan, so do what you can to cut back on the meat you eat.

Sidebar: Are We Really Sure?

Historic scientific caution has created confusion about the certainty of man-made global warming. Ten years ago when widespread research into global warming was beginning, scientists could only report their data *suggested* the Earth was warming and human activities *might* be contributing. Five years ago research was well underway but still incomplete, so scientists could only say *they believed* human activity was a *likely* cause of global warming. Today, scientists have completed enough research for the final report of the IPCC to determine that man-made global warming is "*unequivocal*." U.N. Secretary-General Ban Ki-Moon summarized the scientific certainty at this week's release of third IPCC report. "The world's scientists have spoken clearly and with one voice," he said.

But even though the latest data and the most thorough analysis supported almost unanimously within the scientific community has concluded that man-made global warming is a fact, plenty of 5-year-old and 10-year-old reports which say more study is needed are still circulating. NASA climatologist Dr. Gavin Schmidt explained the undeniable case for global warming this way to the BBC a few weeks ago: Warming is

unequivocal. Weather stations, ocean measurements, decreases in snow cover, reductions in Arctic sea ice, longer growing seasons, balloon measurements, boreholes and satellites all show the results of global warming.

Determined skeptics of climate change would do well to consider the advice the Australian Psychology Society, “Sometimes, if the information is too unsettling, and the solutions seem too difficult, people can cope by minimizing or denying that there is a problem, or avoiding thinking about the problems. The caution expressed by climate change skeptics could be a form of denial, where it involves minimizing the weight of scientific evidence/consensus on the subject.”