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Effects of global warming on polar ice caps

Earth's climate isn't static. It has experienced periods of warmth and periods of extreme cold extending back hundreds of millions of years. In fact, scientists believe that more than 500 million years ago, Earth went through several periods in which the entire planet was completely encased in ice. They refer to this as "snowball Earth" [source: Scientific American]. Eventually, volcanoes spewing carbon dioxide into the atmosphere allowed the planet to warm up.Popular usage has made the term "ice age" a little confusing. In strict scientific usage, it refers to a long period (tens of millions of years) in which the Earth becomes cold enough that permanent ice sheets exist. It's thought that the Earth usually has very little permanent ice. You're probably thinking, "Well, you just talked about the ice sheets that cover Greenland and Antarctica. Does that mean we're living in an ice age?" The answer is yes. We're in a cooling period that began more than 30 million years ago [source: NOVA].Within each long ice age are periods of relative warmth, when glaciers recede, and periods when it gets colder and glaciers advance. These periods are known as interglacial and glacial, respectively. We're currently in an interglacial period. When most people refer to "the ice age," they're talking about the last glacial period.No one is completely sure what causes these long cyclical changes in Earth's climate. It's most likely a combination of many factors:Changes in the Earth's axis and orbit, known as Milankovitch cyclesThe shifting of tectonic platesParticulate matter expelled by huge volcanoes or meteor impacts blocking sunlightAtmospheric compositionThat last reason is the most important. Remember earlier when we mentioned that volcanoes warmed up "snowball Earth" by filling the atmosphere with carbon dioxide? It turns out that's the key to understanding our current problems with global warming.All those prior ice ages and warming periods were caused by natural events, and they took thousands or millions of years to happen. Since the Industrial Revolution, we've been pouring carbon dioxide into the atmosphere ourselves. The result seems to be an increase in the temperature of the Earth that's happening far more quickly than natural processes would suggest.What does this mean for the world's glaciers? There's plenty of evidence to show that they're shrinking. The rate of ice loss in Antarctica is increasing as the glaciers there slide into the ocean more quickly. Antarctica has lost 75 percent more ice between 1996 and 2006 than it used to [source: ScienceDaily]. Ice caps in the Canadian Arctic have shrunk 50 percent in the last century, and could be gone completely within decades [source: ScienceDaily]. Extensive photographic evidence shows glacial retreat worldwide [source: Nichols College]. A glacier in Peru lost 22 percent of its area in less than 40 years [source: The New York Times].Find out more about glaciers, icebergs and other icy stuff by following the links below.Related HowStuffWorks ArticlesNational Snow and Ice Data Center: All About GlaciersAlt, David. Glacial Lake Missoula and Its Humongous Floods. Mountain Press Publishing Company, May 1, 2001.Chorlton, Windsor. Planet Earth: Ice Ages. Time-Life Books, 1983.Gallant, Roy A. Glaciers. Franklin Watts, September 1999.Great Lakes Information Network. "Lake Michigan Facts and Figures." Paul F. and Schrag, Daniel P. "Snowball Earth." Scientific American, Jan. 2000. Kirk A. "Nova: The Big Chill." PBS. Douglas. Frozen Earth: The Once and Future Story of Ice Ages. University of California Press, May 2, 2006National Snow and Ice Data Center. "Quick Facts." Research Institution. "Formation of the Finger Lakes." 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This could happen, but no one knows when it might happen.The Earth's main ice-covered landmass is Antarctica at the South Pole, with about 90 percent of the world's ice (and 70 percent of its fresh water). Antarctica is covered with ice an average of 2,133 meters (7,000 feet) thick. If all of the Antarctic ice melted, sea levels around the world would rise about 61 meters (200 feet). But the average temperature in Antarctica is -37°C, so the ice there is in no danger of melting. In fact, in most parts of the continent it never gets above freezing.At the other end of the world, the North Pole, the ice is not nearly as thick as at the South Pole. The ice floats on the Arctic Ocean. If it melted, sea levels would not be affected.There is a significant amount of ice covering Greenland, which would add another 7 meters (20 feet) to the oceans if it melted. Because Greenland is closer to the equator than Antarctica, the temperatures there are higher, so the ice is more likely to melt. Scientists from the Universities of London and Edinburgh say that ice loss in Antarctica and Greenland together contribute approximately 12 percent of the rise in sea levels [Source: Science Daily].But there might be a less dramatic reason than polar ice melting for the higher ocean level -- the higher temperature of the water. Water is most dense at 4 degrees Celsius. Above and below this temperature, the density of water decreases (the same weight of water occupies a bigger space). So as the overall temperature of the water increases it naturally expands a little bit making the oceans rise. Basically, it all boils down to this: Don't use as much of the stuff that creates greenhouse gases. On a local level, you can help by using less energy. The electricity that operates many of the devices in our homes comes from a power plant, and most power plants burn fossil fuels to generate that power. Turn off lights when they're not in use. Take shorter showers to use less hot water. Use a fan instead of an air conditioner on a warm day.Here are some other specific ways you can help decrease greenhouse-gas emissions:Make sure your car is properly tuned up. This allows it to run more efficiently and generated fewer harmful gases.Walk or ride a bike when you can. Driving your car generates more greenhouse gases than almost anything else you do.Turn lights and other appliances off when you're not using them. Even though a light bulb doesn't generate greenhouse gas, the power plant that generates the electricity used by the light bulb probably does.Recycle. Garbage that doesn't get recycled ends up in a landfill, generating methane; plus, recycled goods require less energy to produce than products made from scratch.Plant trees and other plant life where you can. Plants take carbon dioxide out of the air and release oxygen.Don't burn garbage. This releases carbon dioxide and hydrocarbons into the atmosphere.Cars burn fossil fuel, so smaller, more fuel-efficient cars emit less CO 2, particularly hybrid cars. Walk or ride your bike if possible, or car pool on your way to work.To really stem the emission of greenhouse gases, we need to develop non-fossil fuel energy sources. Hydro-electric power, solar power, hydrogen engines and fuel cells could all create big cuts in greenhouse gases if they were to become more common.At the international level, the Kyoto treaty was written to reduce CO2 and other greenhouse gas emissions worldwide. Thirty-five industrialized nations have committed to reducing their output of those gases to varying degrees. Unfortunately, the United States, the world's primary producer of greenhouse gases, did not sign the treaty.For more information on global warming and related topics, check out How Global Warming Works.Here are some interesting links: According to one school of thought, a warming planet is one that's less likely to wind up in an ice age. Because the Earth is always going through warming and cooling cycles, and we've been in one of the warming cycles for about 12,000 years now, scientists say it's inevitable that we'll hit another big chill sometime in the next 10,000 to 100,000 years. If that happens, much of the world -- including Europe and North America -- would be covered in a thick sheet of ice.According to some researchers, the heat trapped in the Earth's atmosphere from the greenhouse effect will offset this cooling -- essentially preventing the Earth from entering another ice age [sources: Science Daily, Cosmos]. Though averting an ice age sounds like good news, the researchers caution that global warming isn't any picnic, either. It could lead to other drastic and unpleasant effects on the planet (think rising sea levels and dwindling global food supplies)Another school of thought makes the opposite prediction: Global warming might actually lead to another ice age. According to this theory, warming temperatures disrupt ocean currents -- particularly the Gulf Stream, the flow that redistributes warm water from the Gulf of Mexico to northern Europe. As the Gulf Stream makes its deposits of warm water along the coasts of Great Britain and northwestern Europe, it keeps the temperatures there warmer than they would be otherwise.The worry is that, when Arctic ice melts as a result of global warming, huge amounts of fresh water will pour into the North Atlantic and slow down the Gulf Stream. A study of circulation in the North Atlantic has discovered that there already has been a 30 percent reduction in currents flowing north from the Gulf Stream [source: Pearce]. A slowed Gulf Stream could potentially lead to dramatic cooling in Europe.Will either of these scenarios really happen? It's hard to say for sure. Climate experts haven't even come to a consensus about the cause and effects of global warming, let alone whether it might prevent or trigger the next ice age.The question of whether reversing global warming might lead to an ice age could be irrelevant if it never happens. According to a study by the National Oceanic and Atmospheric Administration (NOAA), the changes in ocean surface temperature, rainfall, and sea level that have already occurred are irreversible for a thousand years after carbon dioxide emissions are completely stopped [source: NOAA]. That means no matter how we curb our emissions today, we may not be able to undo the damage that has already been done anytime soon.The one thing scientists do seem to agree on is that another ice age is not likely to occur for thousands of years -- not even remotely close to any of our lifetimes. Global warming is an incontrovertible truth, even if climate change deniers persist. One of the most high-profile presidential candidates is actually repeatedly denying global warming (despite the sheer amount of emissions he must burn keeping his hair in check). And it's taken not one, but four studies to finally refute the myth that global warming had somehow "stopped" in the last decade. We're just not particularly willing to accept that the climate is changing -- or that it may have something to do with human actions.The science behind global warming -- that gas emissions on Earth cause a "blanket" in the atmosphere, enclosing the planet, raising its temperature and altering its climate patterns -- is well known. But in the face of overwhelming images and statistics -- like the emaciated polar bear that went viral this week, seemingly starved by the breakup of ice in its native Arctic by, you guessed it, warming temperatures -- it can seem a bit hopeless.While on a personal level your contribution to lowering global warming is likely to be negligible (unless you happen to be Bill Gates or to own an enormous shipping fleet), there are still small changes to be made that aren't inconvenient and will ensure you're reducing your contribution as much as possible.The differences may be small, but they're worth making -- and adding your voice to political causes to make our lives low-emission may have further impacts than you think. (Also, you'll get to feel really smug.)1. Make Your Household Energy EfficientGreenpeace has a host of global warming initiatives that you can do at home -- and there's quite a lot you can try to reduce your household's energy consumption. Turning off appliances you're not using; getting energy efficient new appliances; making sure you're not lavishly heating or cooling a house unnecessarily; and insulating your house to eliminate the need for extra heating are all good steps to keep your footprint small.2. Get A Home Energy AuditEven if you just rent your house/apartment/share it with five roommates and somebody's kitten, it can be a good idea to ask your utility company for an energy audit. They're basically designed to show you how much energy all your stuff uses, which ones suck up the most, and how you could make things run more efficiently. You'll feel incredibly grown-up -- and probably also a bit horrified when you figure out just how much energy your ancient refrigerator is chewing up per month. (Ask your utility if they have options for green energy in your area, too.)3. Buy Energy Efficient Light BulbsNext time a light blows -- or when you next have the money to go on a blow-out shop (sorry for the pun) in the light bulb aisle -- replace all the lights in your home with more energy efficient alternatives. They're called compact fluorescent bulbs, and while they'll cost more to purchase than ordinary light bulbs, they'll be far more energy efficient and can last up to 10 times longer. Plus, they'll lower your electricity bills while still producing your required amount of light.4. Eat Less (Or No) Meat And DairyOne of the interesting things about food emissions is that "eating locally" may not actually be the greenest way to be. Some small farms may actually be less energy efficient than big ones further away, and the road or air miles may not cancel out the difference.One element climate scientists do agree on, however, is that the beef industry in particular causes huge amounts of one particular greenhouse gas: methane. Even if you're a committed carnivore, it's good for your health not to overly rely on red meat and dairy in your diet -- and good for the planet, too.Just look at the numbers: a staggering 87 percent of the land in America is used just to raise animals for food; it takes 2,500 gallons of water to produce a pound of meat but only 25 gallons to produce a pound of wheat; and the amount of fossil fuels it takes to produce just one hamburger could take a small car 20 miles.5. Travel More SustainablyIf you're going to go around the world, chances are you're going to be reliant on planes -- but, unfortunately, they don't have the best reputation as a green mode of transport. The emissions created by air travel will probably be your most significant contribution to greenhouse gases in your lifetime (though, notably, The New York Times calculated that they total only five percent of all warming -- another indicator that the individual is only a small part of this problem).If you can limit your air travel, do it -- and don't just replace it with a car. Travel via public transport and over short distances wherever possible. If you have to fly, try to go during the daytime; night flights have a higher emission footprint.6. Wash Your Clothes In Cold WaterIf you get the right detergent, washes don't need to be hot -- or even close to it. Hot water washes aren't technically required (and can ruin your clothes anyway), and the estimates on the emission benefits of switching to cold are pretty insane. The National Park Service has the statistics: switching to cold water for two loads a week cuts down your emissions by 550 pounds a year. (Obviously, it's also better to line-dry your clothes, rather than using all the energy up again on a dry cycle.)7. Pick Cars Based On Fuel EconomyOwning a car is, pretty obviously, one of the biggest emission-boosters in a person's life. But if you sincerely can't do what you need to do via public transport or bike, the Union Of Concerned Scientists, a nonprofit lobbying group concerned with global warming, recommends that you do some basic research under the hood of your next car. Fuel efficiency -- the rate at which your car's engine consumes fuel -- is not only a key component of its running cost, it's also a big indicator of its environmental footprint. The more efficient it is, the cheaper, and the greener.8. Sign PetitionsNot all "green" ideology is the same. Environmentalists disagree, for instance, on whether nuclear power is the future of clean energy, or whether geoengineering (deliberate fiddling with atmosphere chemical levels to lower global temperature) is a good idea.So before you start signing petitions, don't just seek out anything that says "lowering emissions" willy-nilly; do your research, look at the most recent science, assess the arguments for and against, and put your voice in the place where you really believe it can help. Change.org and your local government website will have lists of the petitions currently going.Images: Abigail Keenan/Unsplash, Giphy

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