

Science You Can Use

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Dear Science: I heard that a climate change panel recently published dire warnings. What do those warnings mean, and can I do anything about it? -- Buck R.

Dear Buck: The Intergovernmental Panel on Climate Change (IPCC) is an internationally renowned panel of climate scientists who periodically review the best climate-change science we have and assess the likely implications of that science for human welfare. Let's look at what the report published by the IPCC on 9 August 2021 says is happening to climate now, what is likely to happen in the future, and what you can do to help mitigate these changes. In the following, what that report says is closely paraphrased in italics.

What does the report say is happening to climate now?

1. *It is unequivocal that human influence has warmed the atmosphere, ocean, and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere (i.e., frozen regions of the planet, including ice sheets and permafrost) and biosphere have occurred. Large-scale, human-induced climate change is already happening.*
2. *The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years. Taken as a whole, the climate changes are larger and longer than any since the last ice age (about 10,000 years ago).*
3. *Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, are significantly due to human influence. Bad weather caused by human activity is happening more frequently, and in more places, across the planet than at any time since the last ice age.*

What does the report say about our climate future? To assess what we can expect for climate change in the future, the report considers five scenarios, ranging from “business-as-usual” to aggressive reduction of greenhouse gases, especially CO₂ and methane. Based on the scenarios, the IPCC concludes that:

1. *Global surface temperature will continue to increase until at least the mid-century under **all** emissions scenarios considered. Global warming of 1.5°C and 2°C (above the average global temperature, 1850-1900) will be exceeded during the 21st century unless deep reductions in CO₂ and other greenhouse gas (GHG) emissions occur in the coming two decades. Global warming of 1.0 degrees Celsius above the 1850-1900 baseline has already occurred.*
2. *Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events. Floods and droughts will become more common and more severe.*

3. *Many changes due to past and future greenhouse gas emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level.* Even if we drastically reduce GHG emissions now, the emissions to date will have effects far into the future. If we don't act now to sharply reduce GHG emissions, the results will be even worse.

What you can do to help. In the US, most human-produced CO₂ comes from space-conditioning (heating and cooling) homes, internal-combustion-engine (ICE) powered vehicles (see <https://www.caranddriver.com/features/a26962316/how-a-car-works/> for more information), and from electrical generating facilities that burn carbon fuels such as coal and natural gas. Here are some things you can do to help mitigate this problem at home.

- a. Space conditioning
 - a. Insulate the roof of your house to at least R60. Consult an insulating contractor who has a good reputation for additional information.
 - b. Set your thermostat to no higher than 72 F during the day (wear more clothing if you need to) and to no higher than 68 F during the night, in the winter. Set it no lower than 75 in the summer.
 - c. Use pedestal, ceiling-mounted, and exhaust fans to reduce the demand on your air-conditioning system.
- b. Electricity. Add a solar photovoltaic system to your house, sized to meet your household consumption. A typical payback period for such a system under many residential “net-metering” contracts is 12-15 years. (See <https://www.energy.gov/eere/solar/solar-photovoltaic-technology-basics> for more information.)
- c. Food. Minimize your beef consumption. Cow belches are a significant source of methane. In addition, given the way bovines are typically fed in the US, protein from beef indirectly produces about 10 times as much CO₂ per pound of protein as high-protein plants (such as legumes) do.
- d. Vehicles. When it comes time to replace an ICE powered vehicle you own, replace it with a hybrid. (See <https://www.caranddriver.com/features/a26390899/what-is-hybrid-car/> for more information.) Some hybrids produce about half the CO₂ per mile as nominally comparable ICE vehicles do.
- e. Recycle. Making products from recycled materials often produces no more than half the CO₂ produced by making those products from unrecycled materials.

For more information, see IPCC, 2021: *Summary for Policymakers*. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, et al. (eds.)]. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf.

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